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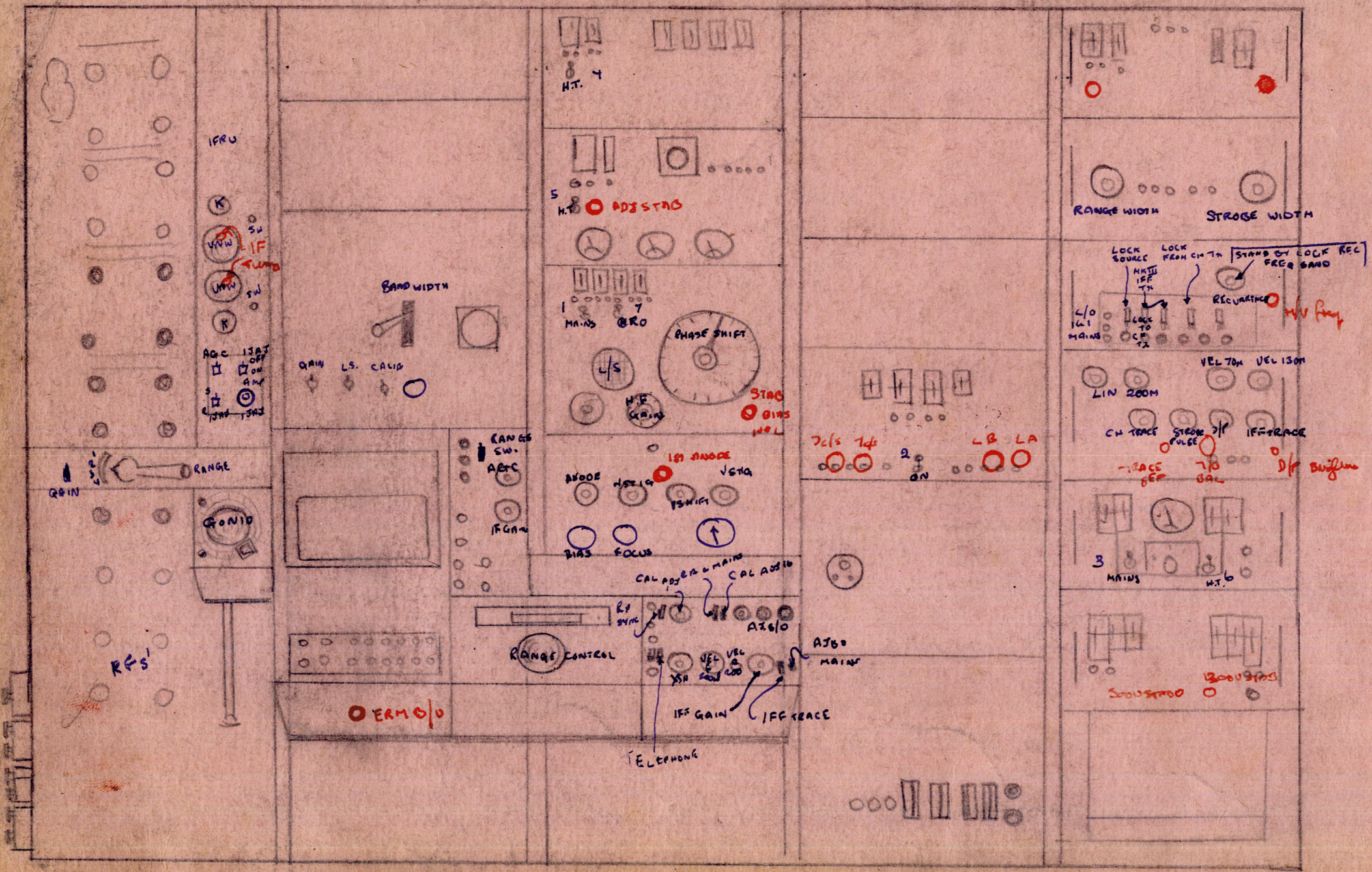
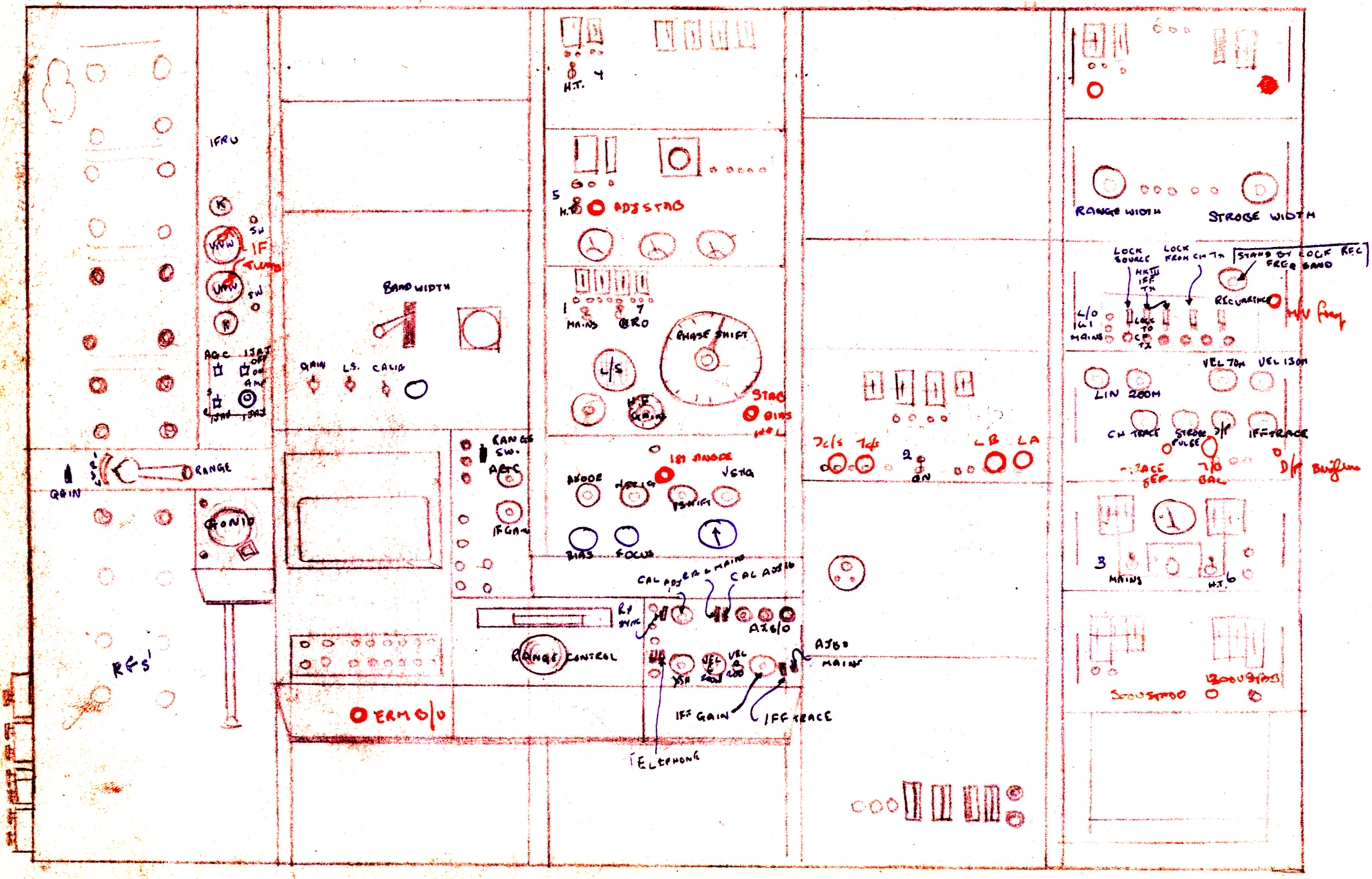
Colin Hinson

In the village of Blunham, Bedfordshire, UK.

R 3106A RECEIVER FRONT



R 3106A RECEIVER FRONT



Meters Reading
Clyde Lazar

T.3104

Circuit Details:

The Tx frequency (it has two push button frequency change). Frequencies are in two ranges:—

1) 20-33 Mc/s
2) 30-50 Mc/s

Power Output is up to a maximum of 400KW. Square wave output

P.R.F. Three possible, 50, 25 & 12.5 pulses/sec.

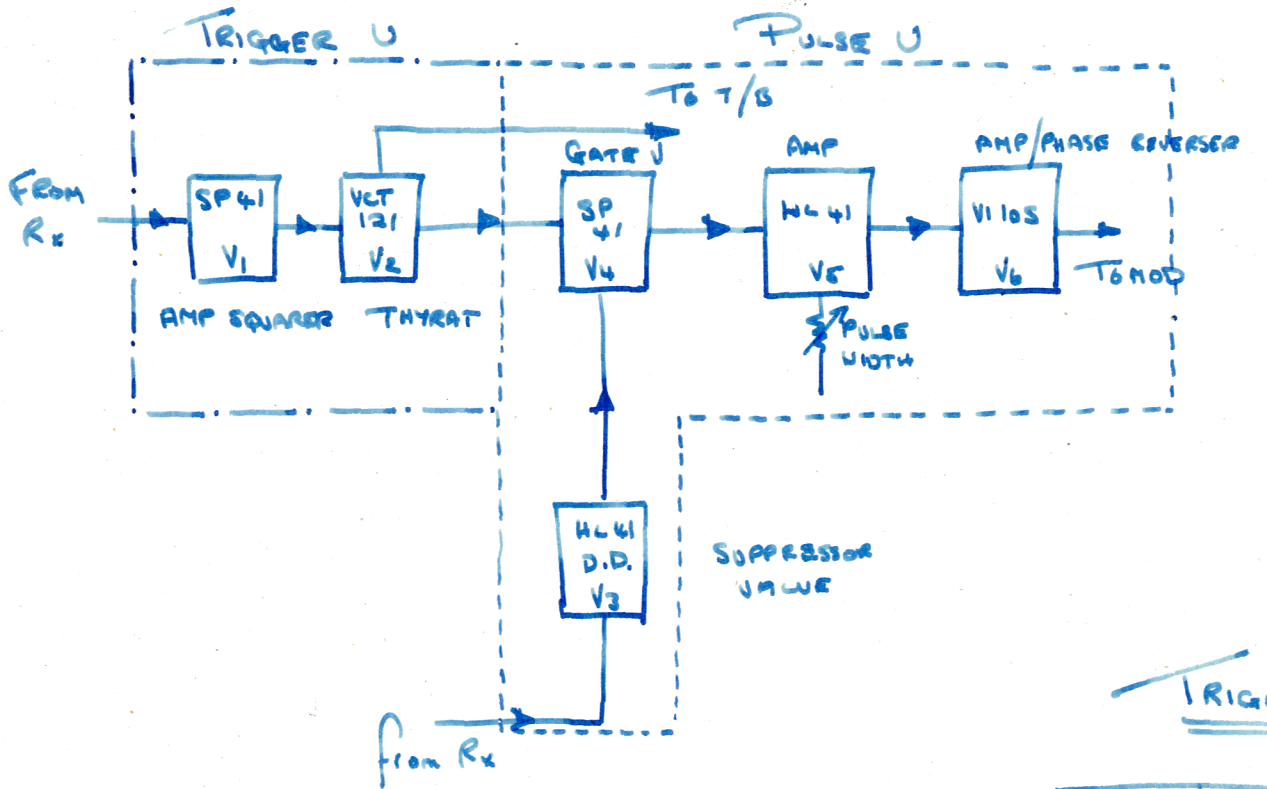
Pulse widths " " 5 μsecs, 7 71 μsecs, 3074 μsecs

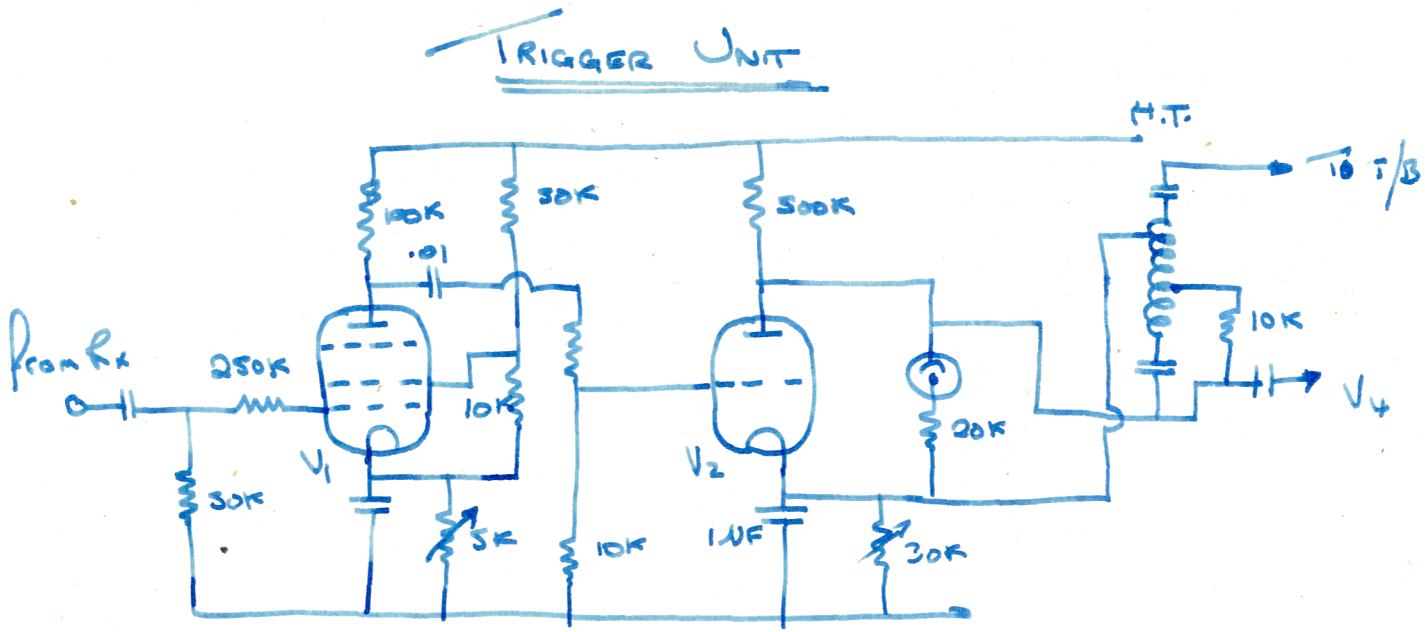
Valves

Modulator Vb. V 1501

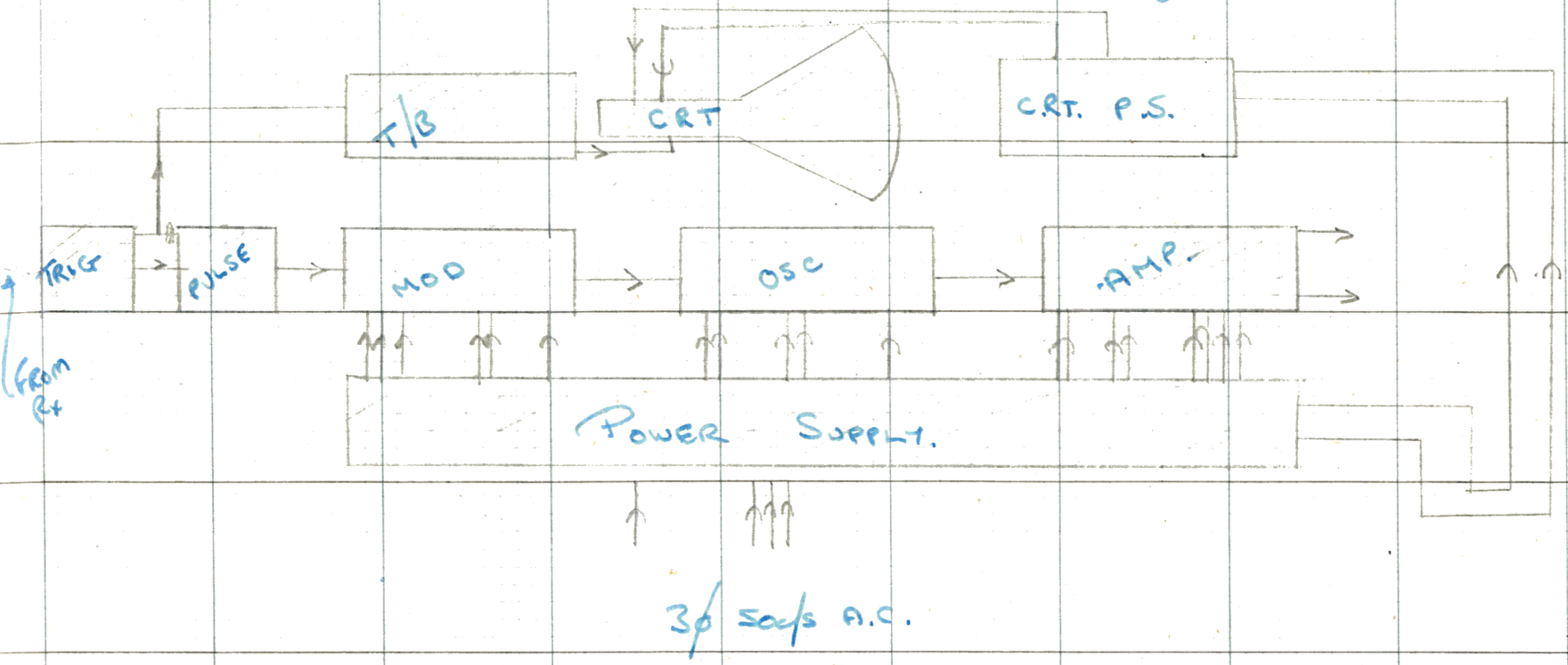
Push Pull Master Oscillator 2 CV1058 triodes in push pull (some use VT.98)

Class 'C' push pull tetrode amp. 2 VT114's in push pull. These feed the aerial


TRIGGER U
PULSE U
TO T/B
FROM Rx
SP 41 V1
VCT 121 V2
GATE U
SP 41 V4
AMP
HL 41 V5
AMP/PHASE CONVERSER
VI 105 V6
TO MOD
PULSE WIDTH
AMP SQUARER
THYRAT
HL 41 D.D. V3
SUPPRESSOR VALVE
from Rx


TRIGGER UNIT
H.T.
TO T/B
100K
.01
30K
500K
10K
V4
From Rx
250K
10K
V1
V2
20K
30K
5K
10K
1MF
30K

Block Diagram



Operation of Trigger Circuit

The square wave looking signal 25c/s supplied by the receiver is applied through the 250K resistor to the grid of V_1. V_1 is biassed by anode current through the 5K resistor and steady current from the H.T. line through 10K and 5K resistors.

If the square wave on the grid of V_1 has sloping sides the striking instant of V_2 is governed by position of 5K variable which forms the "Phase Set" control.

Anode circuit of V_1 is completed by 100K resistor. Output of W/F from V_1 is differentiated by S.T.C. ·01 MFd. 250K + 10K. Anode of Thyratron connected to V_4 by ·02 + ·01 MF condensers.

Operation of V_2

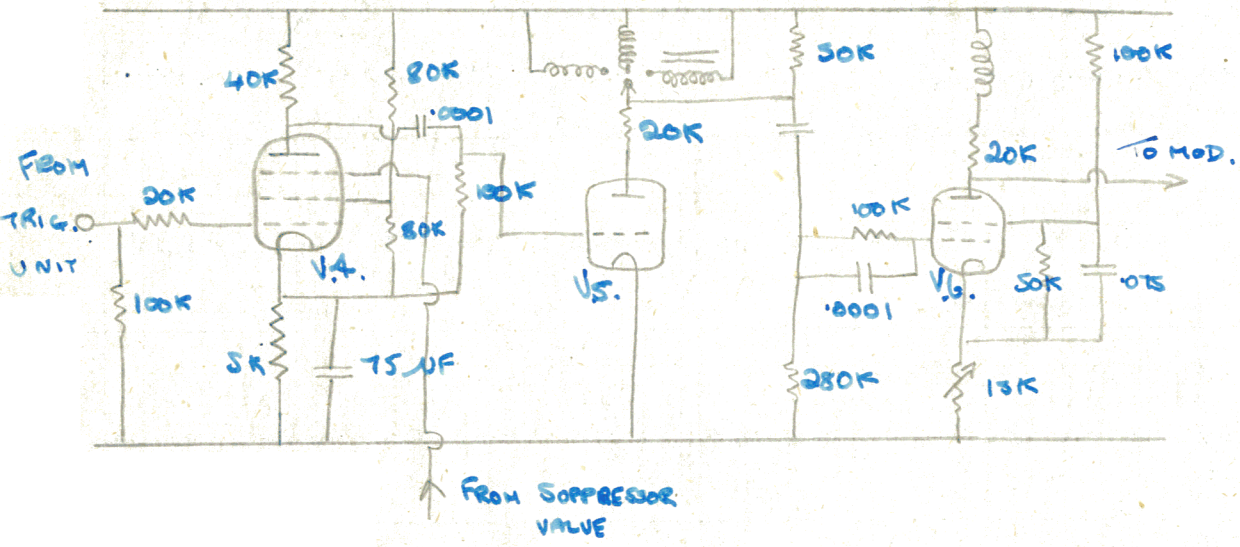
V_2 is non conducting between pulses being biassed by voltage across 30K var. resistor. When large +ve pulses arrive on the grid, the thyratron strikes and two things happen:-

1) The neon is extinguished and
2) The circuit consisting of the bottom half of the inductance, and the ·02 condenser is caused to oscillate at its resonant frequency. As the thyratron is included in the circuit it can only conduct in one direction only one half wave of oscillation takes place the resultant half wave of voltage across the inductance consists of a −ve half wave followed by a +ve half wave at the junction of the ·02 and ·01 condensers. This +ve half wave of voltage forms the pulse which is fed to the grid of V_4 through the ·01 MF.

At the upper end of the inductance a voltage wave is produced consisting of a +ve half wave followed by a −ve one This W/F is fed through the ·001 to provide triggering for the time base.

The T/B is triggered by the +ve crest therefore the T/B will commence 180° before the transmitter pulse is produced.

PULSE UNIT



Operation

The +ve pulse from the trigger unit is fed through the 20K resistor to the control grid of V_4. The main use of V_4 is to provide a gate valve whereby each alternate pulse may be cut off for 2½ c/s working.

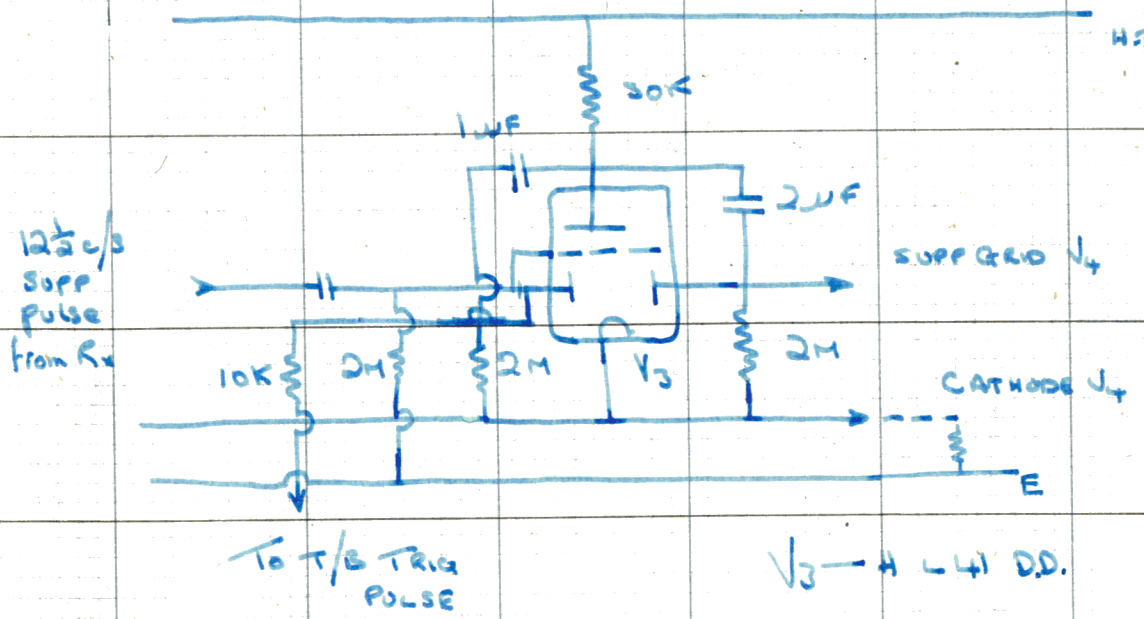
The -ve pulses from V_4 anode are passed to the grid of V_5 through the ·0001 μF condenser.

V_5 is provided to enable the pulse width to be adjusted by means of three switched chokes in the anode circuit. The chokes can be remotely selected by means of relays built into the pulse unit.

The +ve o/p from V_5 anode is passed via the pulse shaping network ·5 μF, 100K, ·0001 μF & 280K to the grid of V_6. The variable bias on grid of V_6 goes beyond cut off by the variable resistor (5K) which forms the "WIDTH TRIM CONTROL". Variation of the bias adjusts the point at which anode current flows, and gives fine control of pulse width.

In the anode circuit of V_6 is a choke, providing a large overswing at the beginning of the pulse to cause the R.F. oscillations to build up rapidly at the beginning of the R.F. pulse.

T 3104 Suppressor.

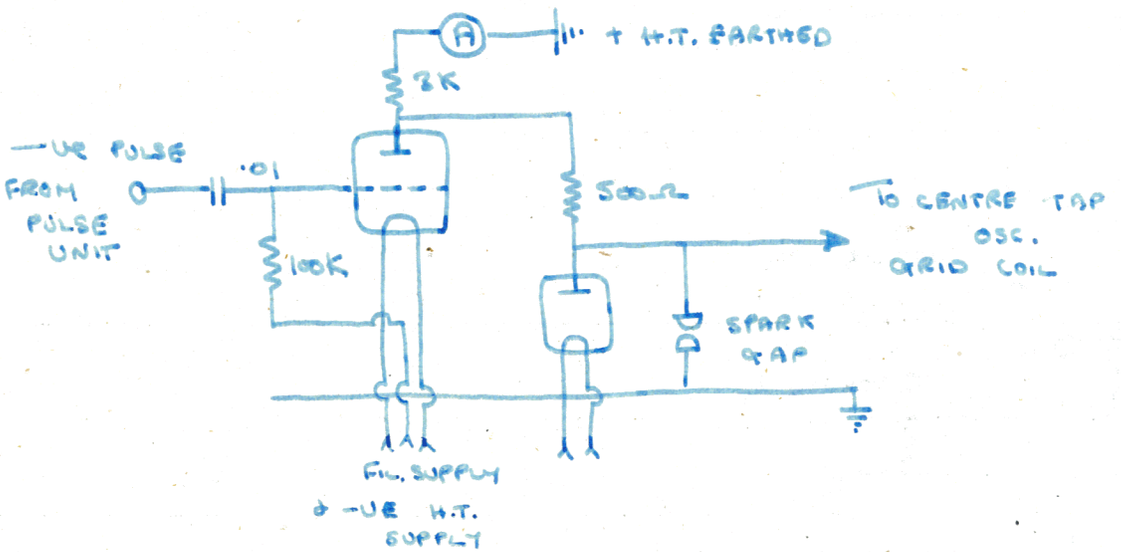


Operation

When the 12½ c/s suppressor pulse is applied from the receiver through the 1μFd. condenser to the grid of V_3 -ve going pulses are formed at the anode which are applied through the 2μFd. condenser to the suppressor grid of V_4 these cut off each alternate 25 c/s locking pulse. The suppressor grid of V_4 is also connected by means of a 2M ohm resistor to its cathode. This resistor is shunted by one of the diodes in V_3 which -vely D.C. restores the supp pulse at V_4 supp. grid. The -ve pulses at V_3 anode are also applied to the remaining diode of V_3. This diode anode is connected through a 2M ohm resistor to the cathode of V_4, and through a 10K resistor to the T/B triggering source. In this way each alternate T/B triggering pulse is suppressed causing the T/B to trigger only 12½ times per second

MODULATOR VALVE

CIRCUIT



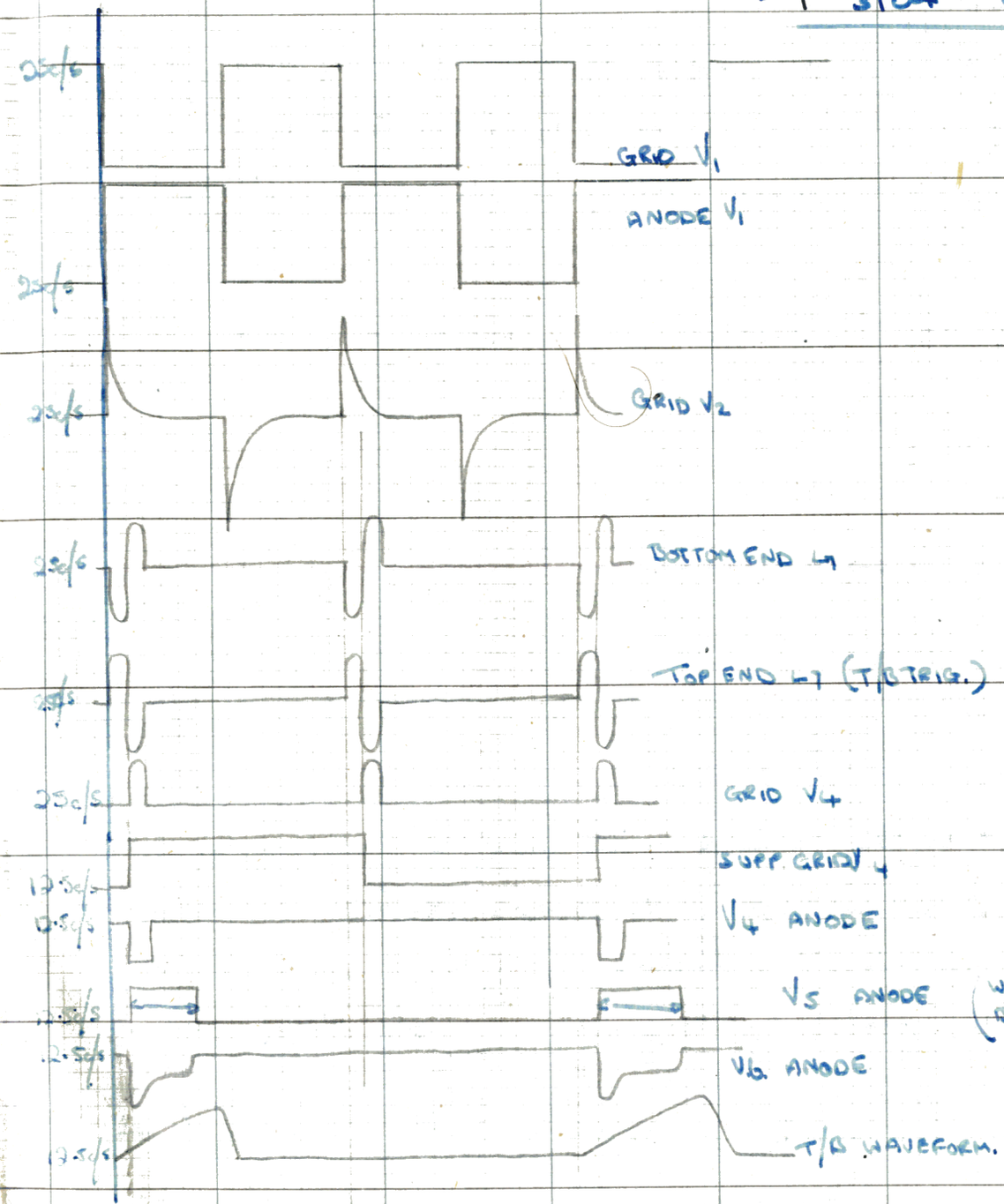
Operation

The diode modulator valve is normally conducting due to its grid being at the same potential as the cathode. The heavy current being passed by the valve causes a voltage of approx 1500 volts to be dropped across its 3K anode load.

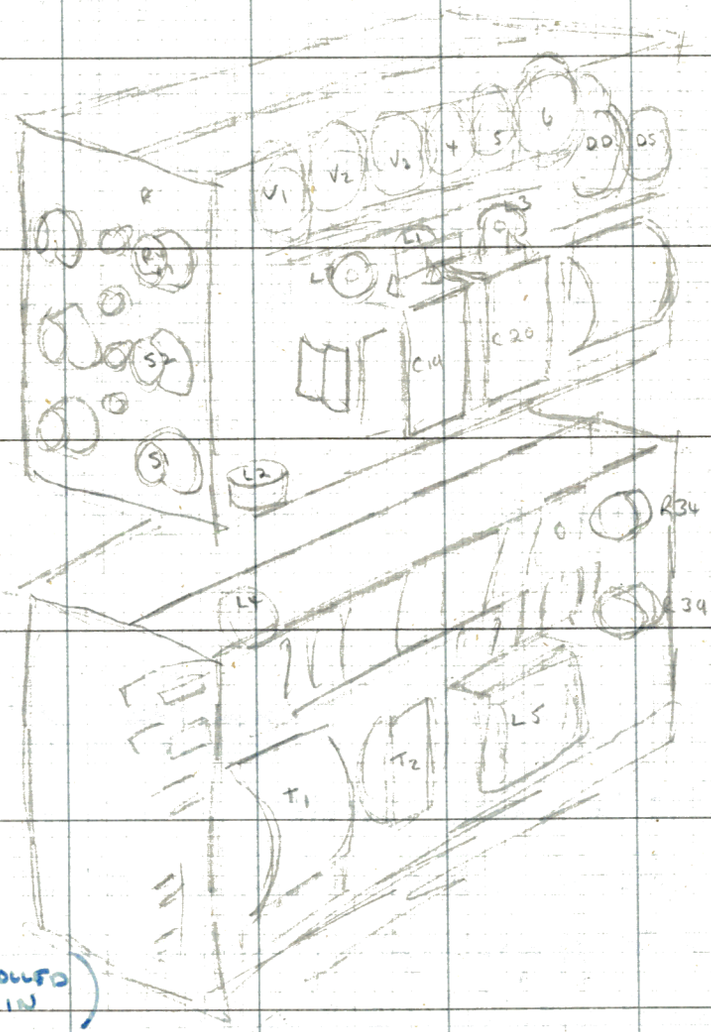
As the +ve side of the H.T. supply is earthed the anode of the modulator will be -ve with respect to earth. The centre tap of the oscillator grid coil is connected to the mod. valve anode via the 500Ω resistor and is held at -1500 volts while the valve is conducting. When the -ve pulse arrives on the mod valve grid, the valve is cut off resulting in the sudden reduction of bias on the oscillators and the commencement of R.F. oscillation. A safety spark gap is provided between the Osc grids and earth to avoid damage to the mod valve and its anode load in the event of flash over between osc. ~~grid~~ valve grid and anode.

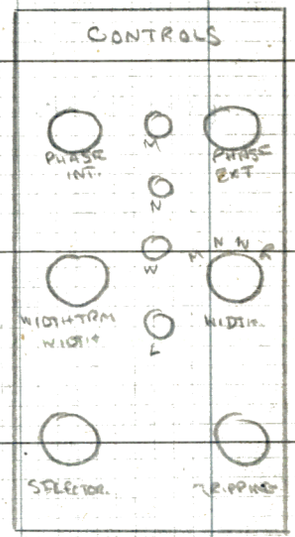
The diode across the spark gap prevents secondary emission and the osc. grids going +ve during the pulse period.

T3104 Waveforms



MODULATOR LAYOUT





INTERNAL LOCKING

The grid of V_3 is coupled through the 1Mfd. condenser C8, and V_1 grid is connected to the secondary winding of T_2, which provides the 50c/s voltage of approx. 50 volts amplitude which is required by V_1 due to the driving of V_1 into grid current and the cut off of anode current on the -ve half cycle. The phase of the 50c/s voltage is varied by a phase shifting network in the firing cct. of T_2.

In the thyratron cathode circuit a switch adjusts the time constant of the biasing circuit, to permit the thyratron to conduct on either ① Each +ve pulse on its grid.

② Every second pulse on its grid

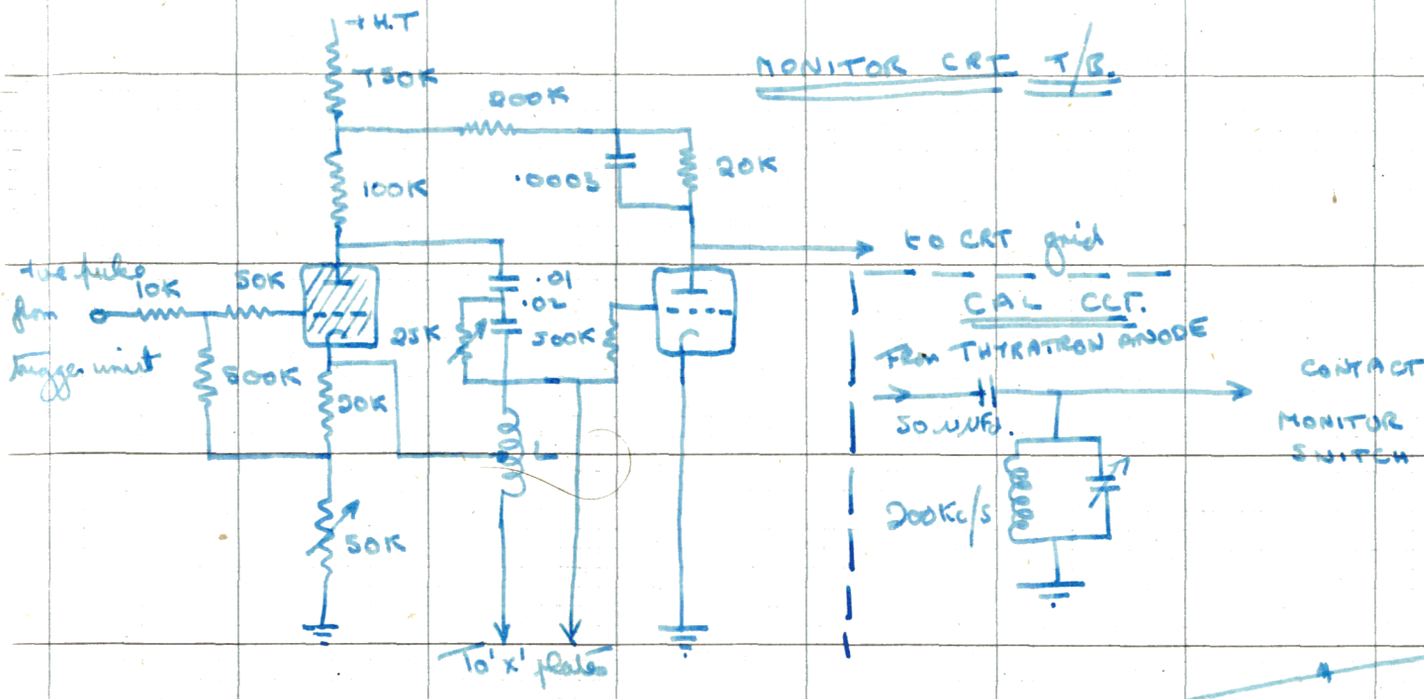
or ③ Every fourth pulse.

From V_4 onwards, all the circuits fulfill the same function as on external locking.

MONITOR CRT T/B.

The thyratron, which is normally cut off, is caused to conduct by the arrival on its grid of the +ve triggering pulse from trigger unit. The .02 and .01 discharge through top half of coil L. Voltage developed in this half reproduced in lower half, due to magnetic coupling. X plates are connected to coil ends. The discharge time of .02 .01 is varied by 25K variable resistor — "TIME SWEEP" control. Thyratron then extinguished by large drop in anode voltage across high resistance in its anode load cct.

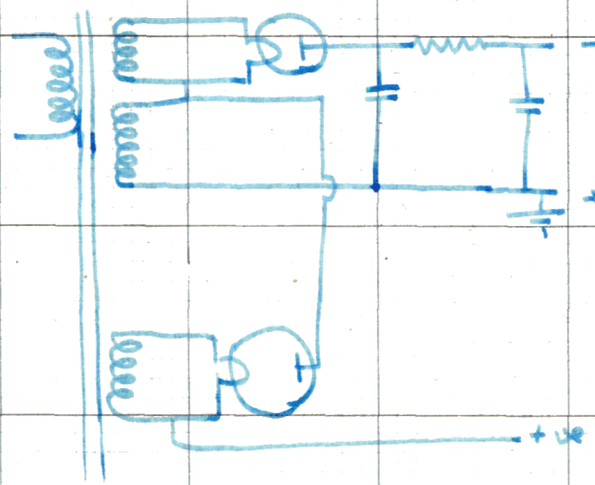
Bright up valve, normally conducting, cut off when its grid goes negative due to voltage at the upper half of coil L +ve pulse produced at anode which is fed to grid of C.R.T. This +ve pulse removes the large black cut bias normally



MONITOR CRT T/B.

— applied to the grid on the forward stroke of the T/B.

Calibration of the T/B is carried out by means of a tuned cct., resonant at 200Kc/s which is caused to ring by sudden drop in voltage at the thyratron anode, which is coupled to the tuned cct. by a 50 μμFd. As the freq. of tuned cct. is 200Kc/s, the interval of time between consecutive +ve peaks will be 5 μ secs.



H.T. supplies

C.R.T. H.T.

C.R.T. H.T. circuit is conventional and needs no discription

T/B H.T.

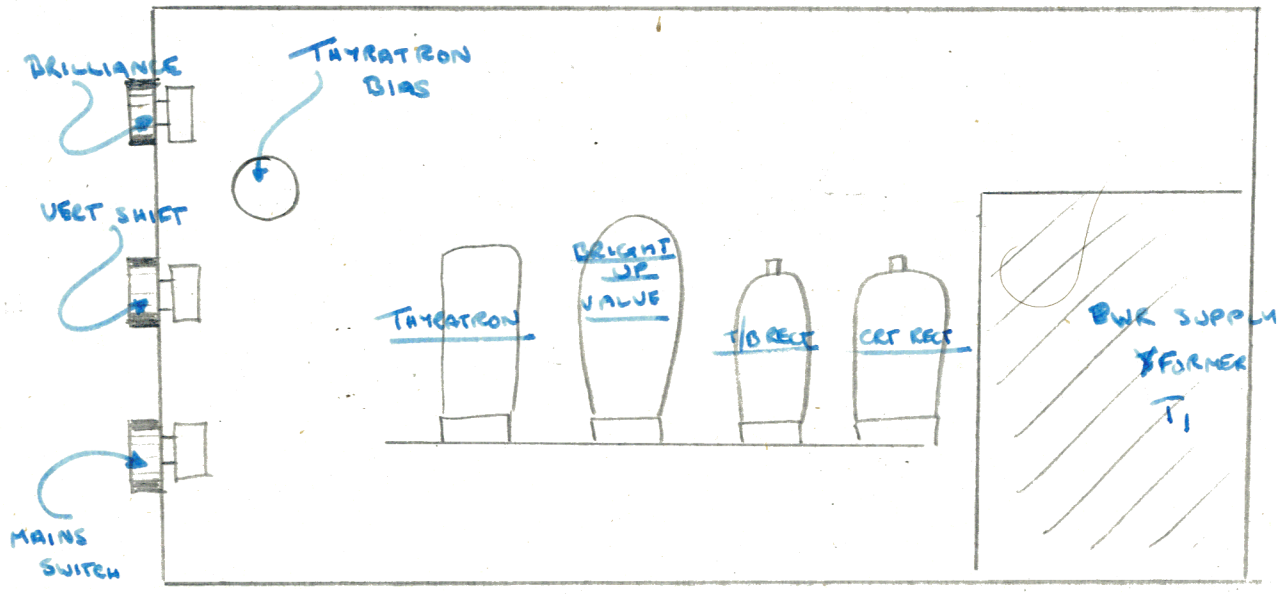
Power Supplies -

The power supply for both T/B and C.R.T. is derived from a power supply on T/B chassis

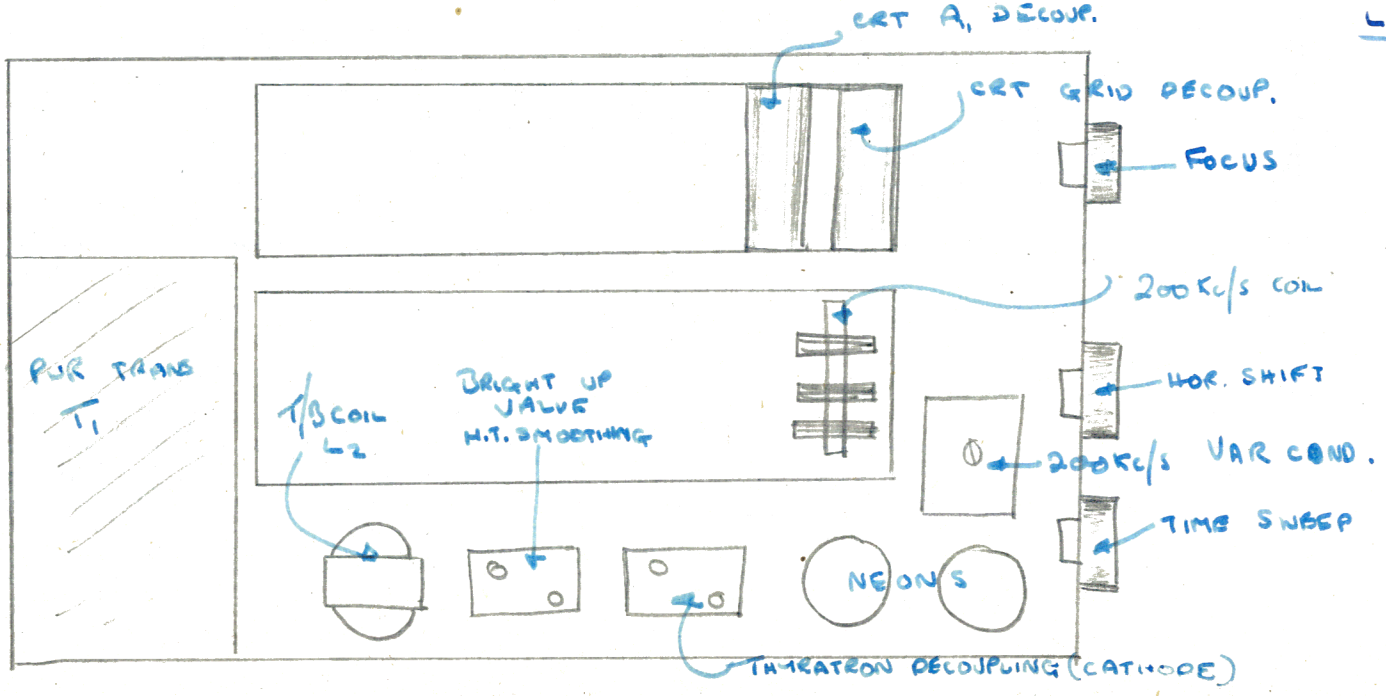
One H.T. winding on the x former supplies both +ve unregulated H.T. for T/B and -ve HT for C.R.T. by the use of two separate recs.

T/B UNIT LAYOUT

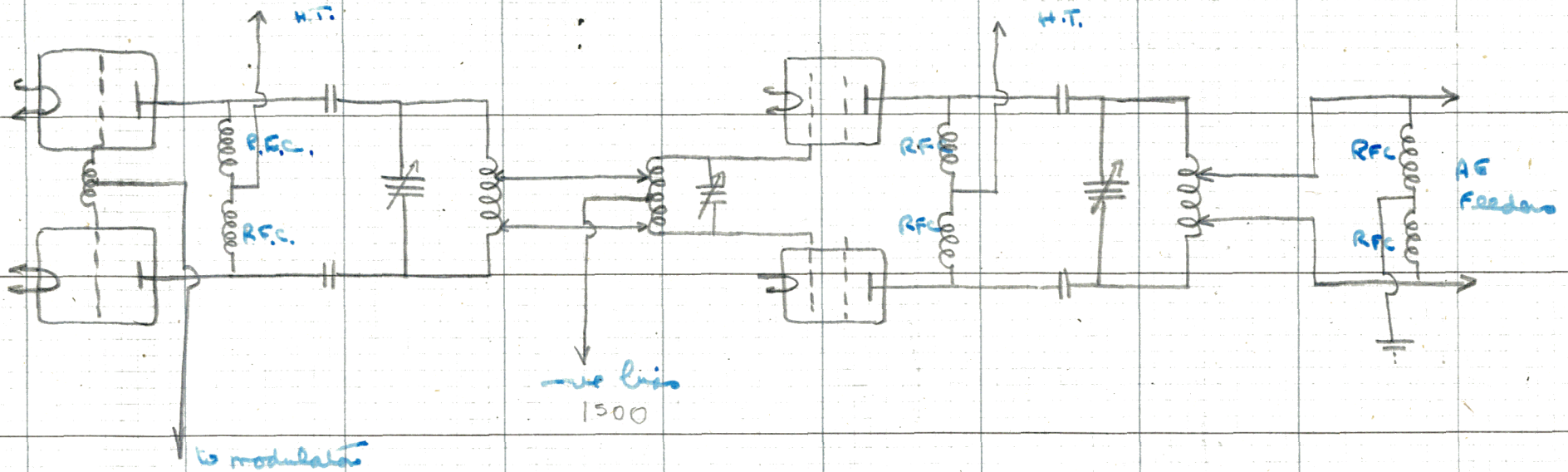
RIGHT HAND SIDE



LEFT HAND SIDE



RF. CIRCUITS.



OSC

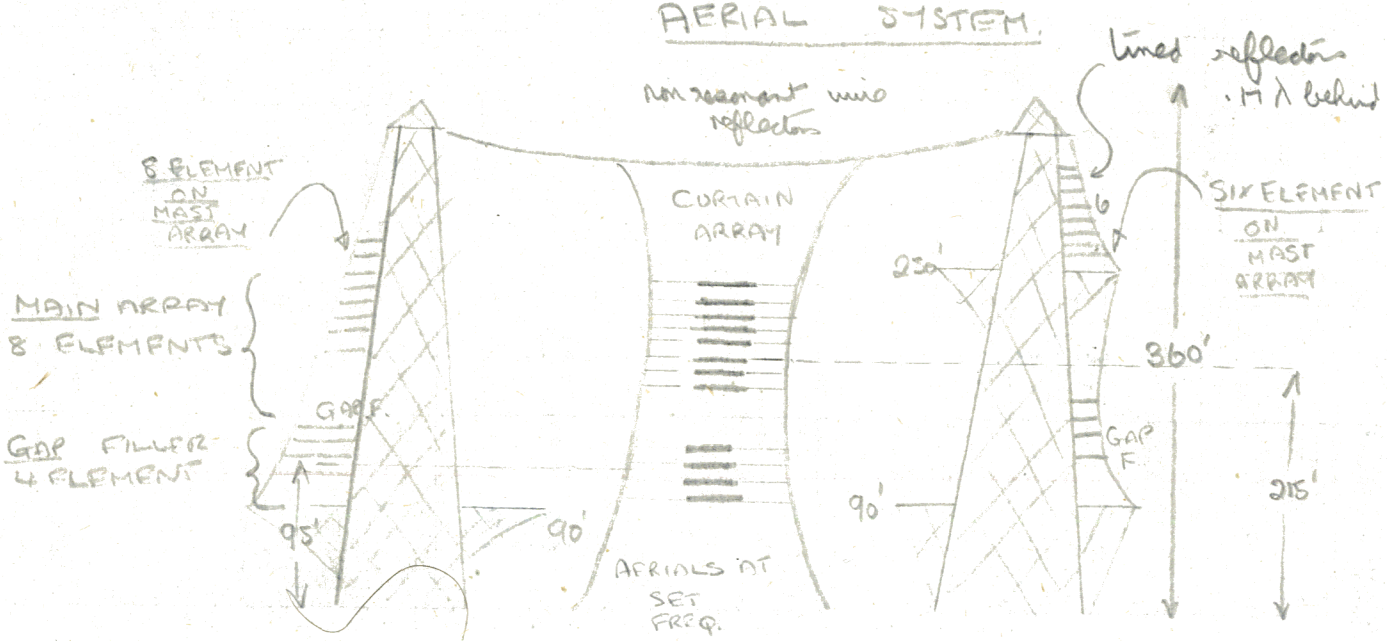
AMP

The oscillator stage consists of two VT 58's or VT 98's in a P.P. T.A.T.G. osc. Alternative anode and grid circuits may be selected by a push button controlled wavechange system. The tuning of the oscillator grid circuit is done by tappings on the coil the centre of which goes to mod. valve anode. The osc. anode cct. is tuned by both tappings on the coil, and split stator condenser. The crystal tune cct. is shunt fed from the anodes by R.F. chokes and coupling condensers.

The PA stage comprises two VT 114's in P.P. Coupling from osc stage to grids is by means of a short length of twin feeder tapped across a small section of the respective coil at each end. The PA. grid cct. is tuned by tapping on the coil and a split stator condenser. The PA. anode cct. is tuned by tapping on the coil and in some transmitters by a split stator condenser. Alternative coils are provided in the PA circuit for wave changing in the same manner as the osc. circuit. The o/p to the aerials is taken from

tappings on the shunt fed anode coil, across the aerial feeders are connected two R.F. chokes in series with the centre point earthed. This arrangement results in a balanced output to match the aerial feeders. Change over of the aerial feeders is accomplished by waveband system.

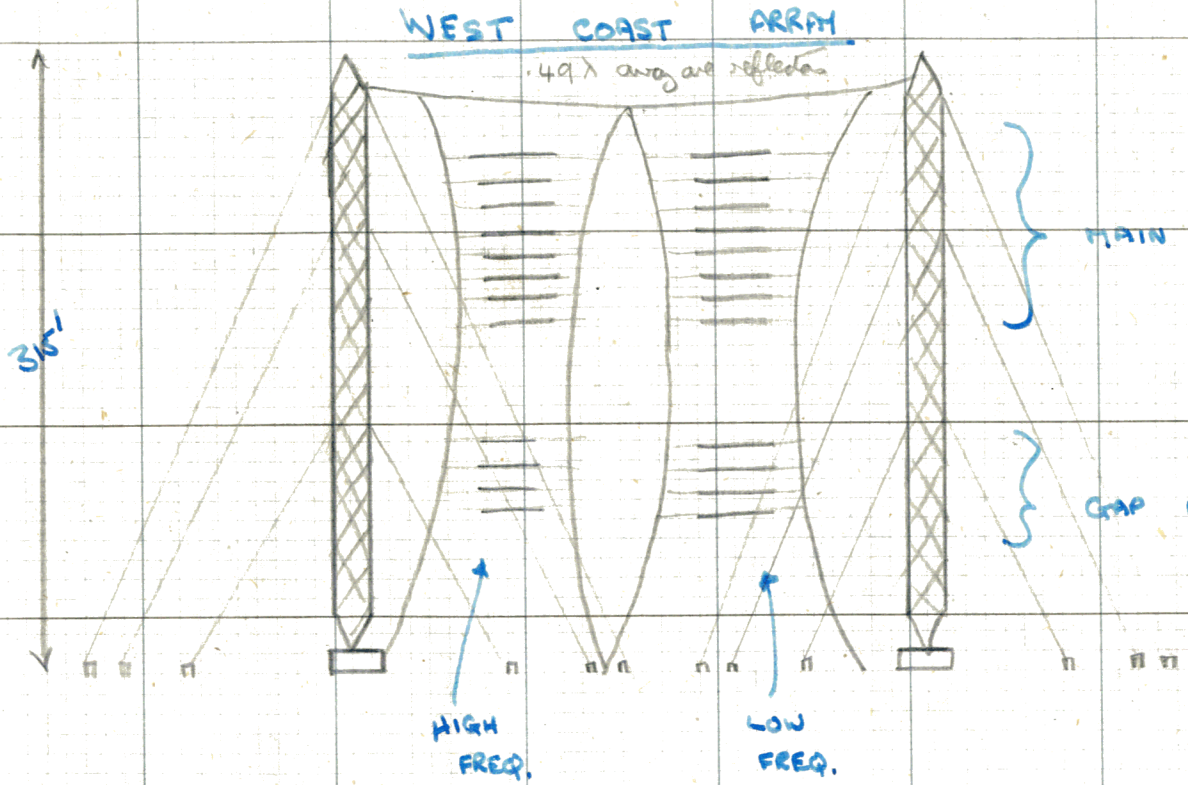
AERIAL SYSTEM.

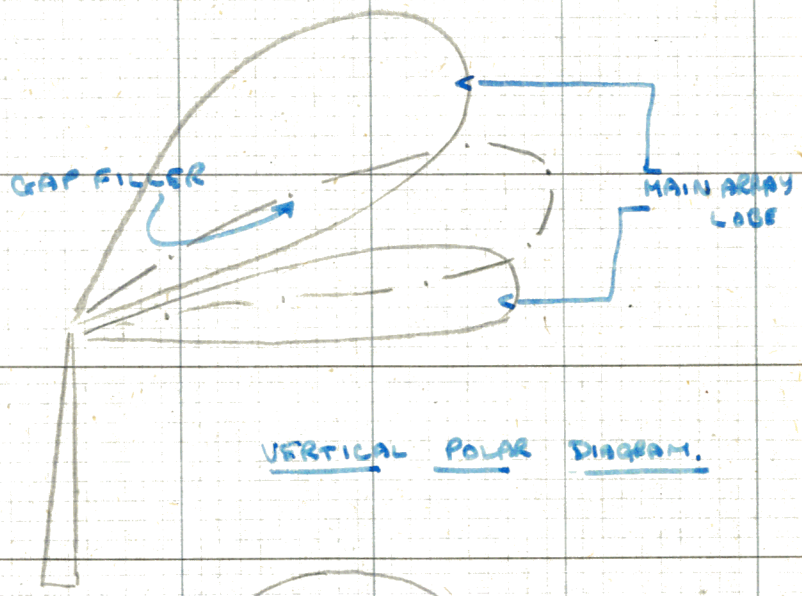


EAST COAST ARRAY

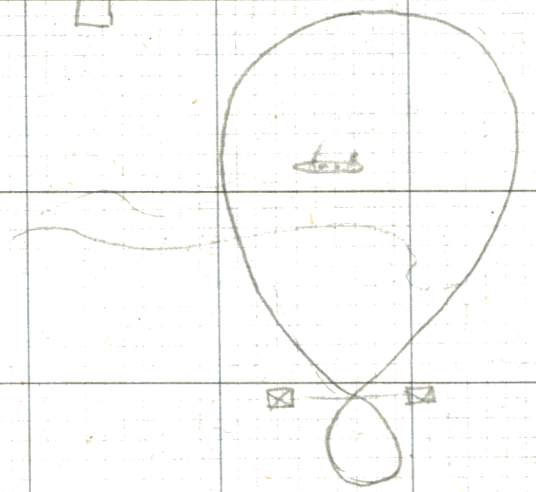
ARRANGEMENT OF STACKED DIPOLES

Most stations use a combination of a curtain array and one of the on mast systems





VERTICAL POLAR DIAGRAM.



HORIZONTAL POLAR DIAGRAM

Contactor System

1) Isolator switch in position "B" ⟶ A.C. is applied to Fan 1, T15 primary, mains voltmeter and is available for the control circuits

2) Fan 1 tilt switch and "Fil Aux" on isolator switch set up circuit for switching on filaments

3) "Fil on" button is pressed energising O/C_1 contactor (1) closes and completes mains supply for mains transformer "Aux" (1) contacts bridge "Fil On" button and TD (1) is started

4) TD (1) closes energising O/C_2, contactor 2 closes, completing Fan 2 circuit; shorting R_{13} & part of R_{12}, and R_{11} & part of R_{10}, and starting TD 2

Fan 2 tilt switch partially completes circuit of O/C_3

5) TD (2) closes and energises O/C_3. Contactor 3 closes shorting remainder of R_{12} and R_{10} (and so applying full voltage to fils) and starting Fan 3, & TD_3. Fan 3 tilt switch partially completes circuit of "Fil On" lamp

6) TD (3) closes, completing "Fil On" lamp circuit and, when isolator switch is put in position "C" setting up circuit for O/C_4.

7) "Mon On" button is pressed, energising O/C_4

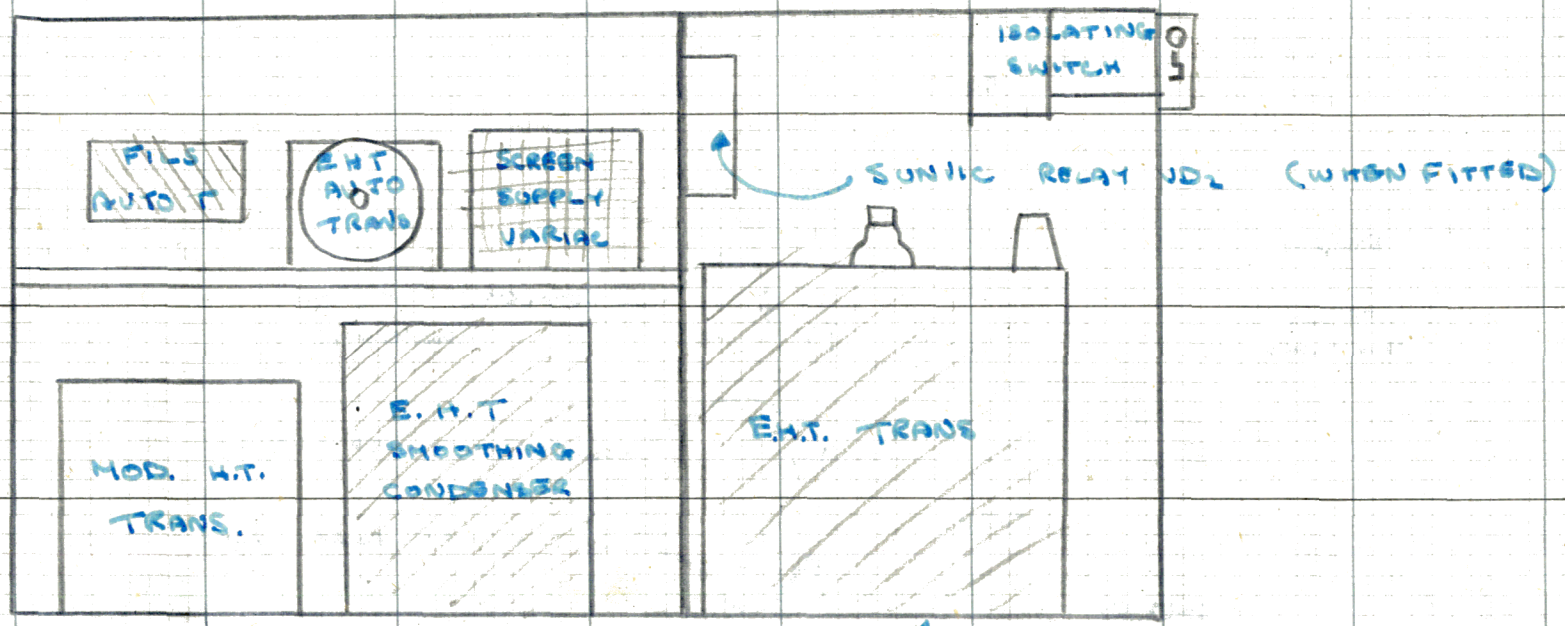
Aux_4 contacts bridge "Mod on" button, contactor 4 closes switching on AC to line supply transformer setting up circuit for screen H.T. trans. completing AC supply to mod. H.T. trans and R_{43} in series (series with mod H.T. X form) and starting SUNVIC relay VD_2

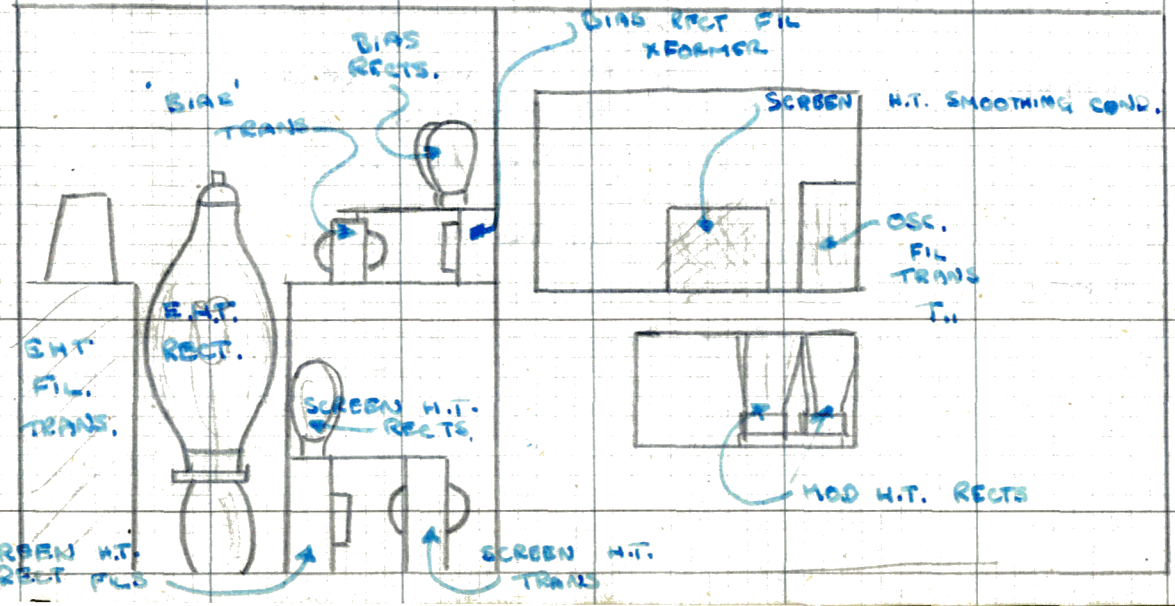
8) VD_2 closes, shorting R_{43}, and so applying full H.T. to mod valve and setting up circuit for O/C_5

9) "H.T. on" button is pressed, completing O/C_5 circuit, Contactor 5 closes applying AC, through R_{35}, to H.T. auto-transformer, and starting VD_1. When VD_1 closes shorting R_{35}, full H.T. is applied to oscillator valves, and "OSC. HT" lamp lights to full brilliance.

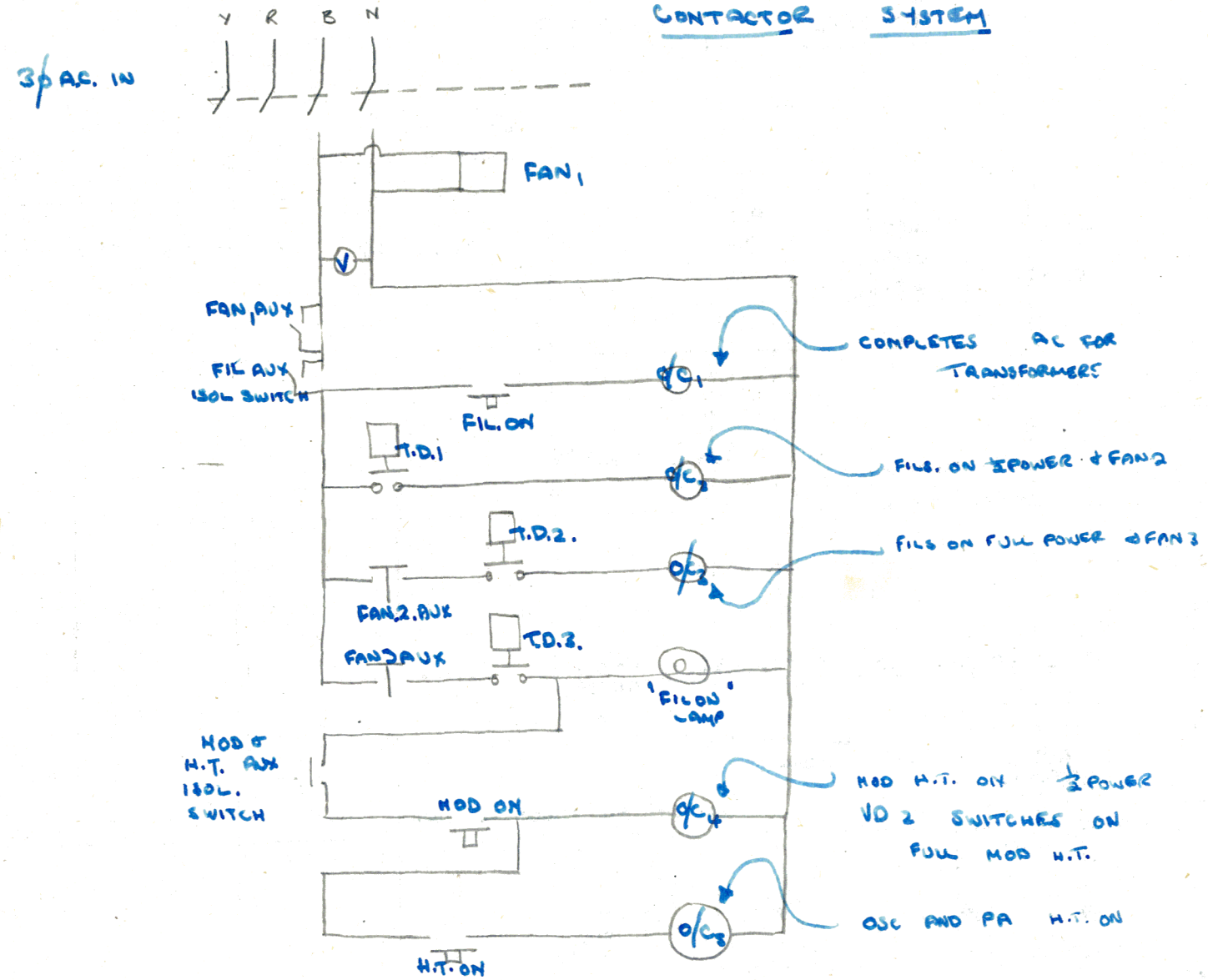
10) H.T. is applied to amplifier when isolator switch is in position "D".

POWER UNIT LAYOUTS





CONTACTOR SYSTEM



Function of Cooling System.

Fan 1 : Code Amplifier and Oscillator compartment.

Fan 2 : Modulator and T/B

Fan 3 : Power Supply units

Measurement of Power Output.

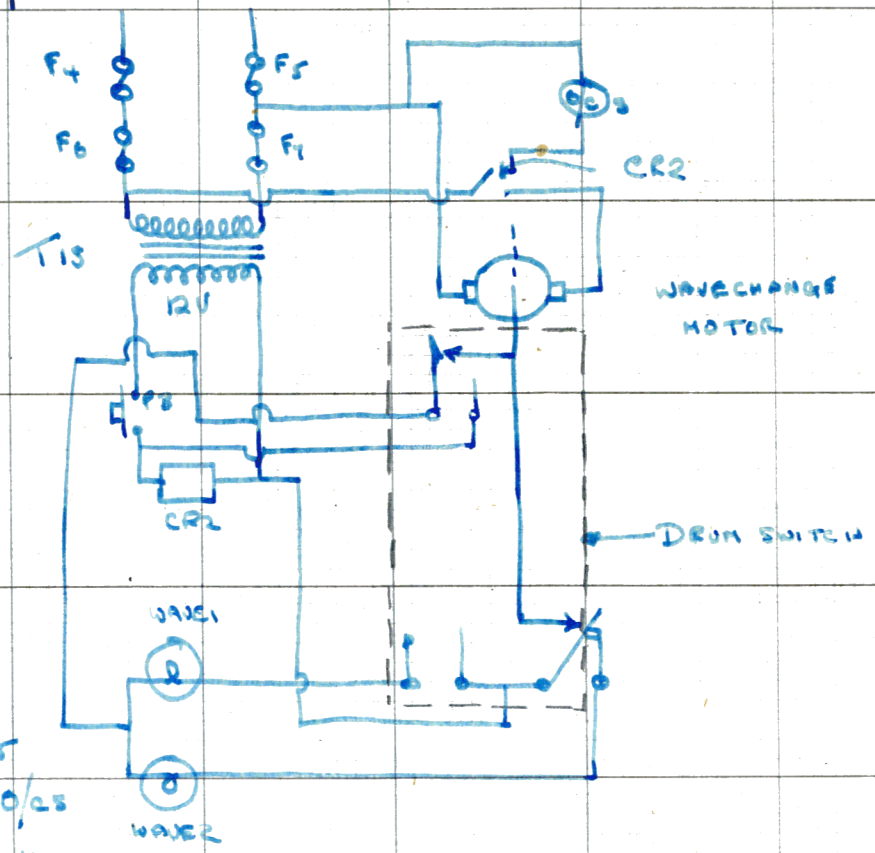
is done, as in G2, by means of rheostat and lamps the rheostat is scaled.

Wavechange Operation

The wavechange motor control circuit is fed through fuses F4, F5, F6, F7. Reads as for the operation of the wavechange lamps and CR2 is as described for T15

When PB is pressed, CR2 is energised and its contacts disconnect O/S (switching off main H.T.) and energise the wavechange motor which operates the W/C switches and the drum switches, which shut the PB, and connect 12V supply to the appropriate lamp.

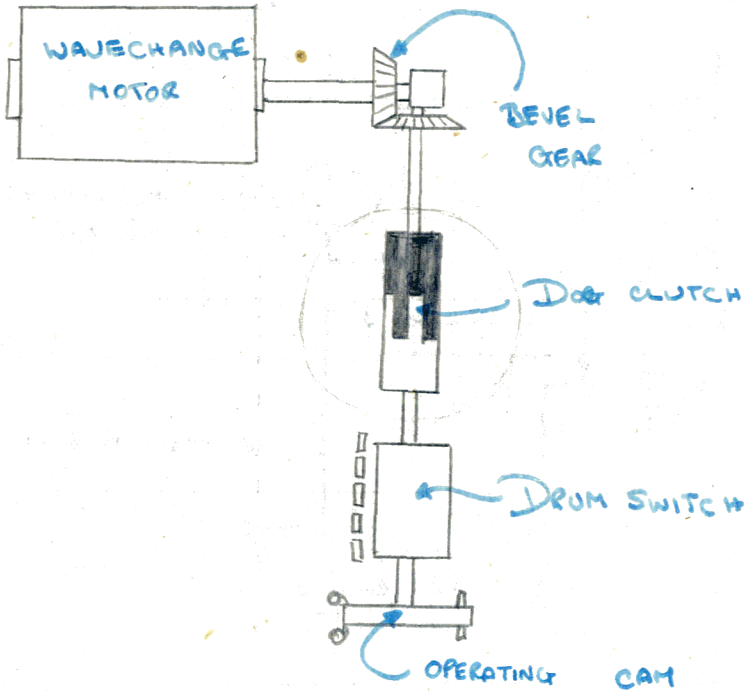
Wavechange System



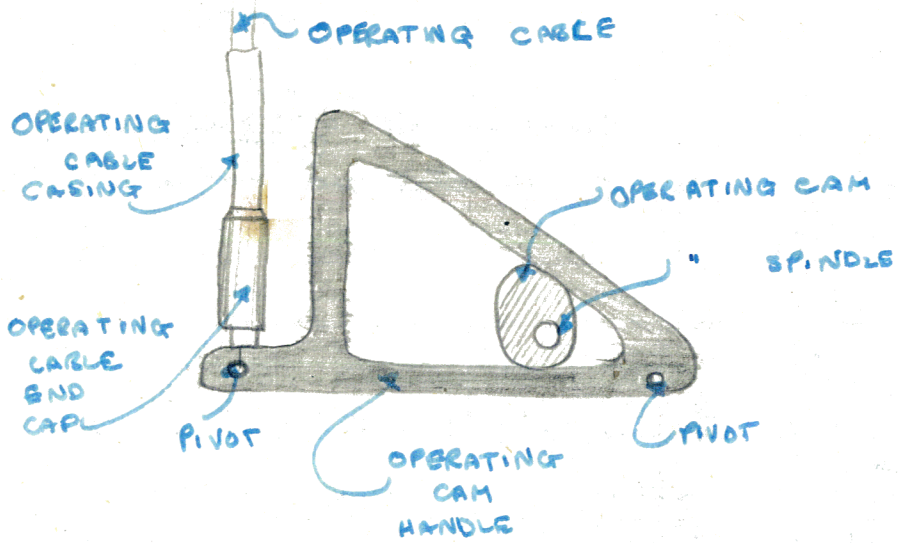
~~Running Up~~

Wavechange System

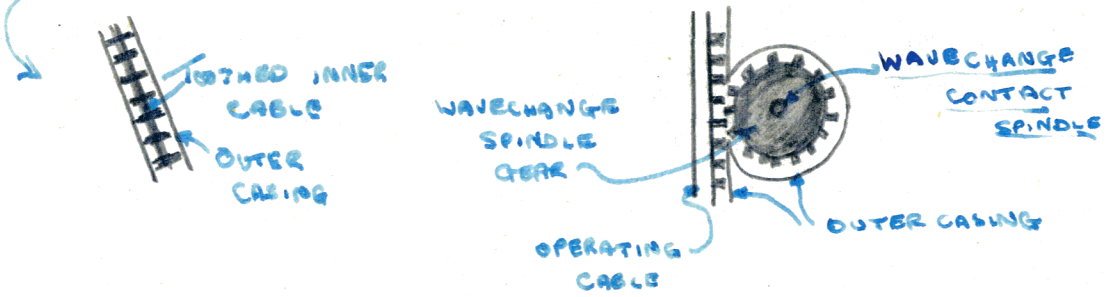
PLAN VIEW OF WAVECHANGE MECHANISM.



OPERATING CAM END VIEW

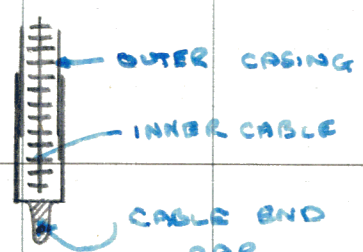


SECTION OF OPERATING CABLE



SECTION OF SPINDLE OPERATING GEAR

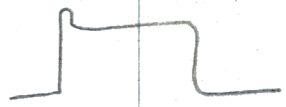
WAVECHANGE MECHANISM. (CONT.)



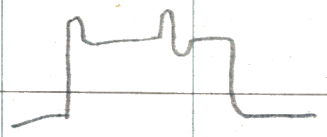
END CAP IS SLIDING FIT ON OUTER CASING

Running Up. T3104.

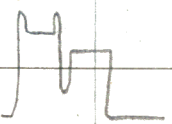
1) Put isolator switch into position A
2) Press "Fil On" button (this supplies power to fils. and pulse and trigger units) T/B and CRT can switched on by switch on Modulator unit. Wait until all fans are running. Filament and wave lamps should now be alight. Check filament volts and adjust if necessary. Put isolator switch in position D. Press mod on button and check mod valve current this should be approx .5amps. Adjust CRT to get a clear trace on tube. Put waveform selector switch on trigger and pulse unit to position T. Waveform on CRT should be approx:—



Check amplifier G.B. it should be approx 1— 1·2 KV Press main H.T fresh button and turn screen grid voltage control to approx. 1KV. Main H.T. control to std 6 KV T trace on CRT should now be approx:—



If all correct turn screen and H.T. controls to maximum position and trace on tube should now be:—



Maximin permissable readings on meters should now be:—

osc anode current — 2mA

Amp. anode " — 13 mA

Amp. Screen current — 1 mA

" grid " — between 2 & 4 mA

No main H.T. wallmeter.

AMES TYPE 1

R.3016A

General Data

a) Sometimes known as R.F.8 [Rack 23 included]

b) Ranges i) 200 nls
ii) 130 nls.
iii) 70 nls

c) Freq range
20-60 Megc/s

Bandwidth
i) 20-30 Mc/s [in use at present]
ii) 26-38 Mc/s
iii) 32-50 Mc/s
iv) 40-60 Mc/s

R.3016A SETTING) UP INSTRUCTIONS.

Running Up.

1. Switch "ON" at the supply source.
2. Switch "ON" mains on P12, ACC4 and mains on P21.
3. After approx. 30 secs. switch on H.T. switches on P11 & P10.
4. Switch on H.T. switches on P.21 and CRO switch on P12.
5. Adjust anode control on HP4 for a voltmeter reading of 5.5 - 6 KV after allowing approx. 30 secs for "warming up".
6. Adjust BIAS control for visible trace.

Running Down.

1. Turn BIAS control fully anti-clockwise.
2. Switch off in following order.
   a) CRO on P12 panel.
   b) HT " P21 "
   c) HT " P10 & P11 panels.
   d) MAINS on P21 panel.
   e) ACC4 panel.
   f) MAINS on P12 panel.
   g) Break MAINS input at source.

B/U CHAIN

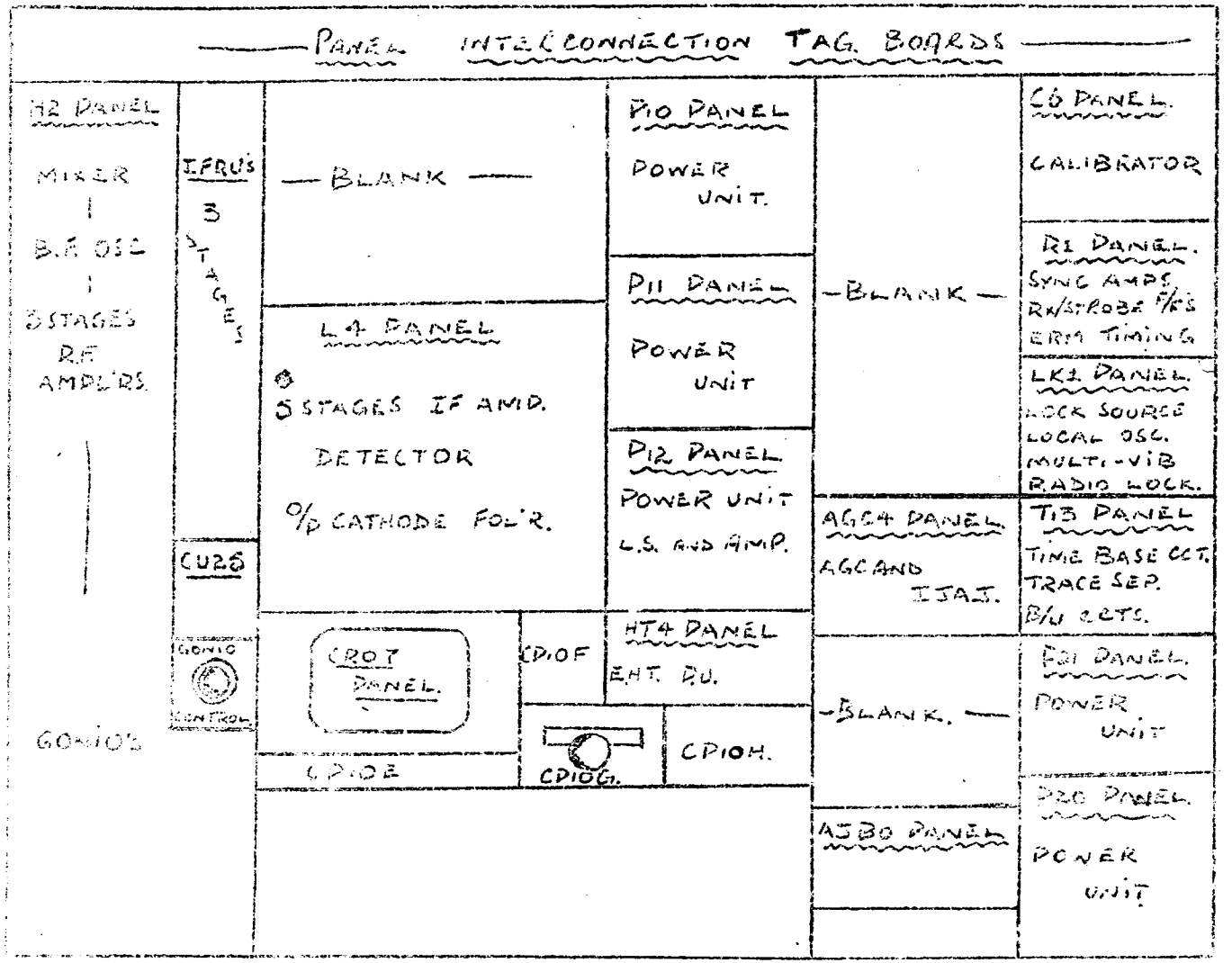
1. Switch on Rx as detailed in "Running Up" procedure.
2. Switch on MAINS and HT on console.
3. Switch on CAL MAINS on CP10H.
4. Put Rx SYNC SELECTOR switch to CAL position.
5. Select 200M time-base with range switch(CP10F)
6. Turn all brightener controls(T13)fully anti-clockwise.
7. Adjust BIAS control until the time-base and spots at its commencement just disappear.
8. Turn CH trace brightener until time-base re-appears at desired brilliancy.
9. Set Rx SYNC SELECTOR switch to NORMAL, and IFF trace switch to ON (CP10H).
10. Set IFF switch(LK1) to NOT IN USE position.
11. Adjust IFF trace brightener(T13) until IFF trace is barely visible.
12. Adjust STROBE & DP brighteners for visible pulses, after ensuring that DP control on console is set to display the DP on a 200M time-base.
13. Check that adjustments are correct for 130M & 70M time-bases.

ERM.

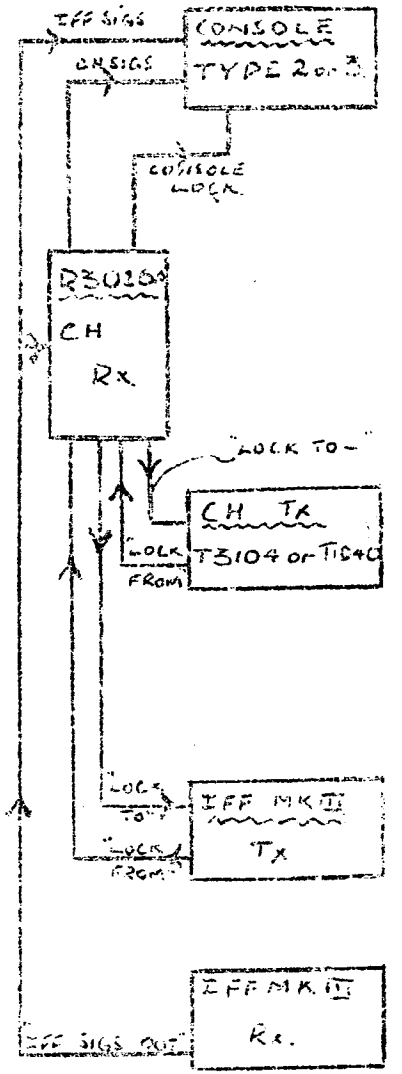
1. Switch on CAL MAINS and select CAL sync.(CP10).
2. Ensure that at least 16 cal. markers are displayed. If necessary adjust RANGE WIDTH control on R1 panel.
3. Set ERM range control(CP10G)to the red 1 mark on the range drum.
4. By means of CAL ADJUST 1 control(CP10H) move range marker to cover first visible cal. marker.
5. Set ERM range control to red 16 mark on the range drum.
6. By means of CAL ADJUST 16 switch, move range marker to cover 16th cal marker.
7. Re-check adjustment as in para 5.

N.B. THE "CAL ADJUST 16 SWITCH MUST BE OPERATED FOR BRIEF PERIODS ONLY.

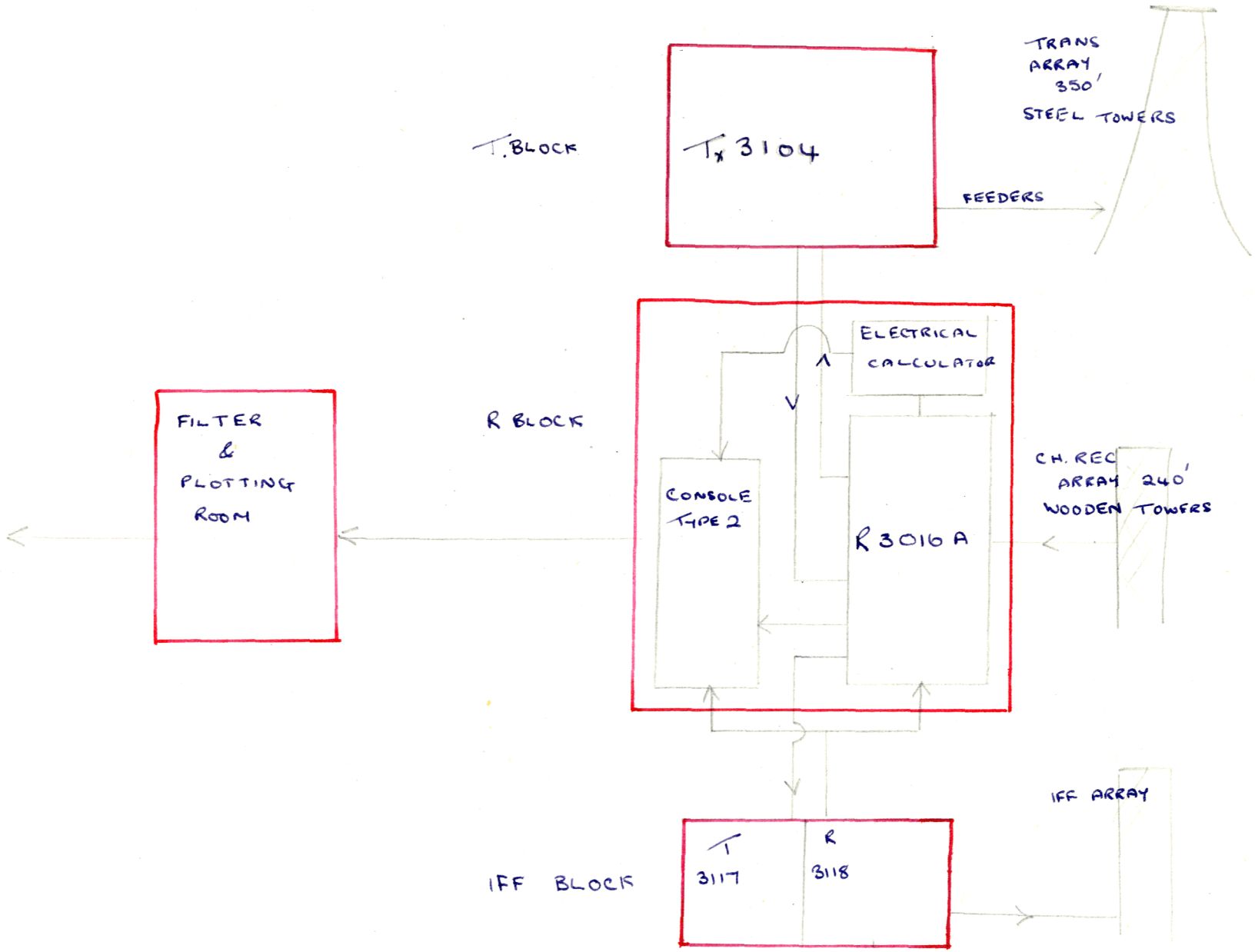
R3010A - LAYOUT OF PANELS

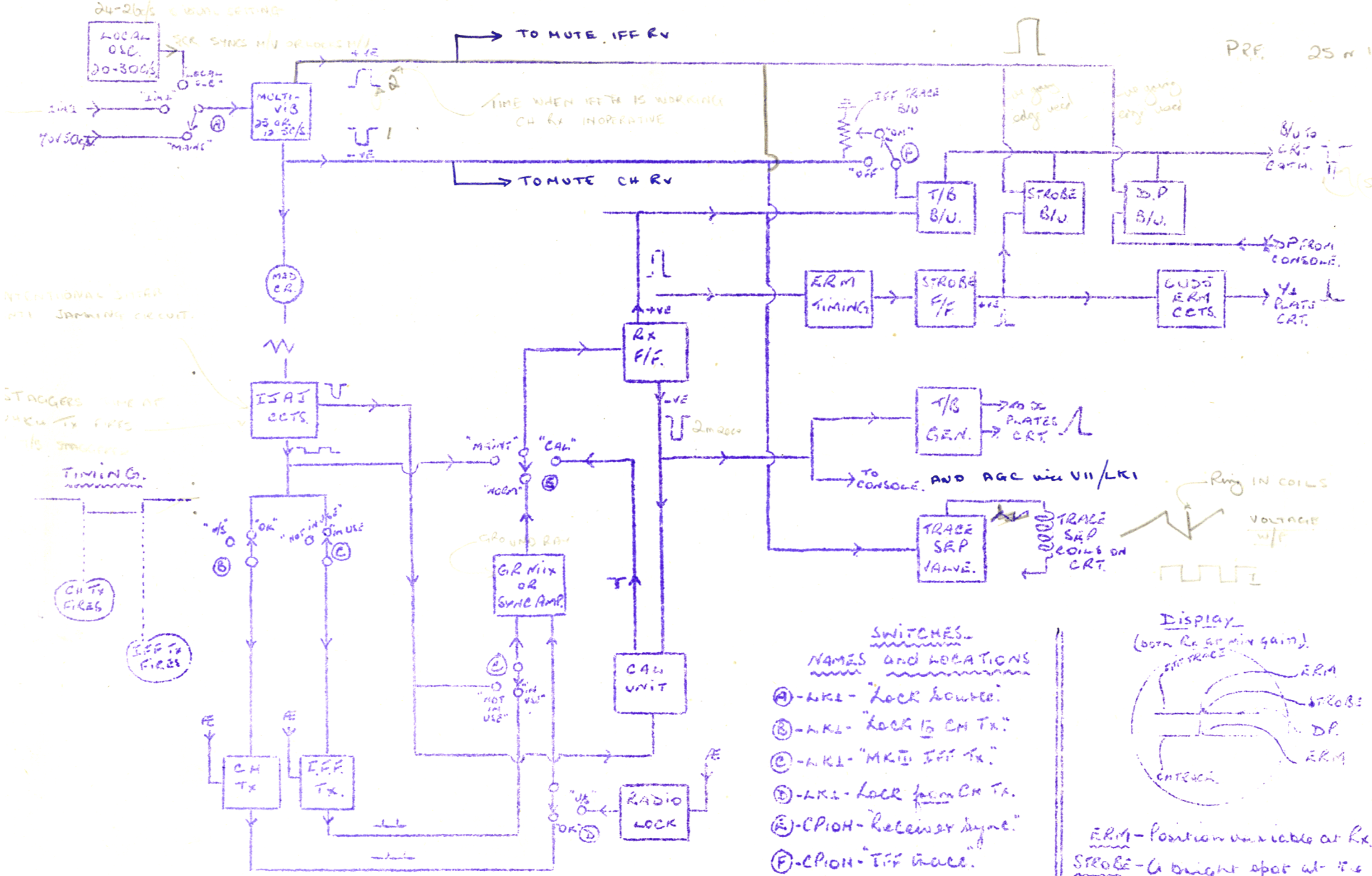


AMES TYPE 1



GENERAL PLAN OF TYPICAL STATION





R3010 - SIMPLIFIED BLOCK CIRCUIT

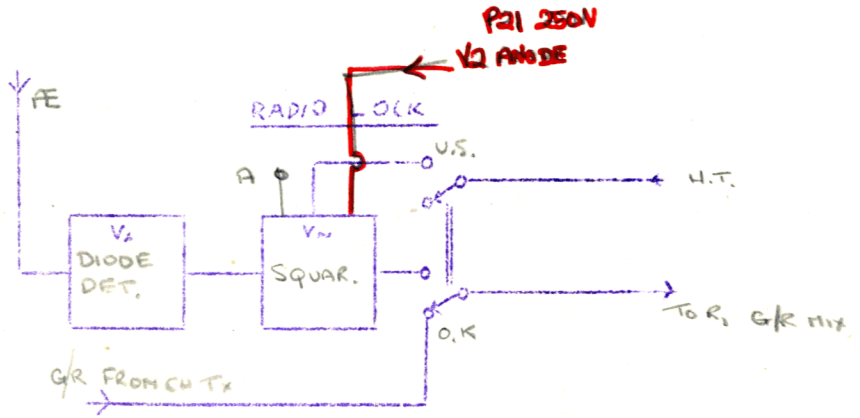
SWITCHES.
NAMES AND LOCATIONS

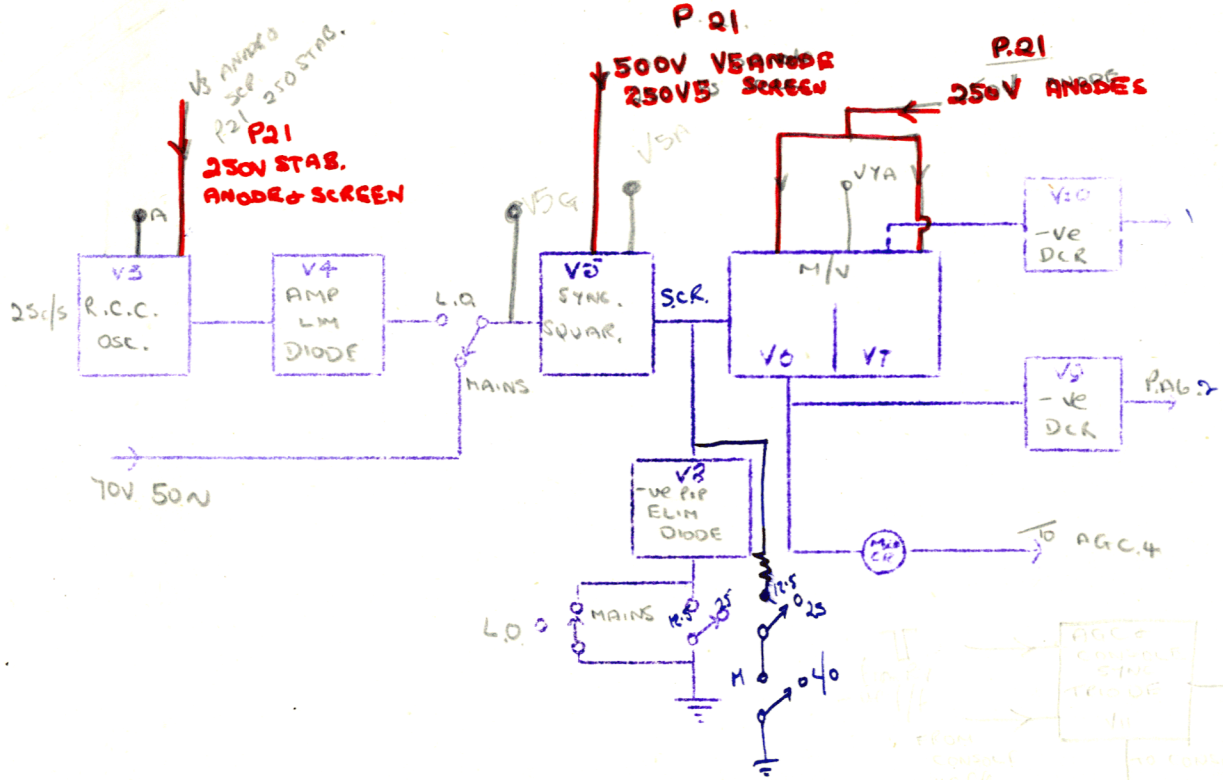
(A) - LK1 - "Lock source."
(B) - LK1 - "Lock to CH Tx."
(C) - LK1 - "MK III IFF Tx."
(D) - LK1 - Lock from CH Tx.
(E) - CP10H - "Receiver sync."
(F) - CP10H - "IFF trace."

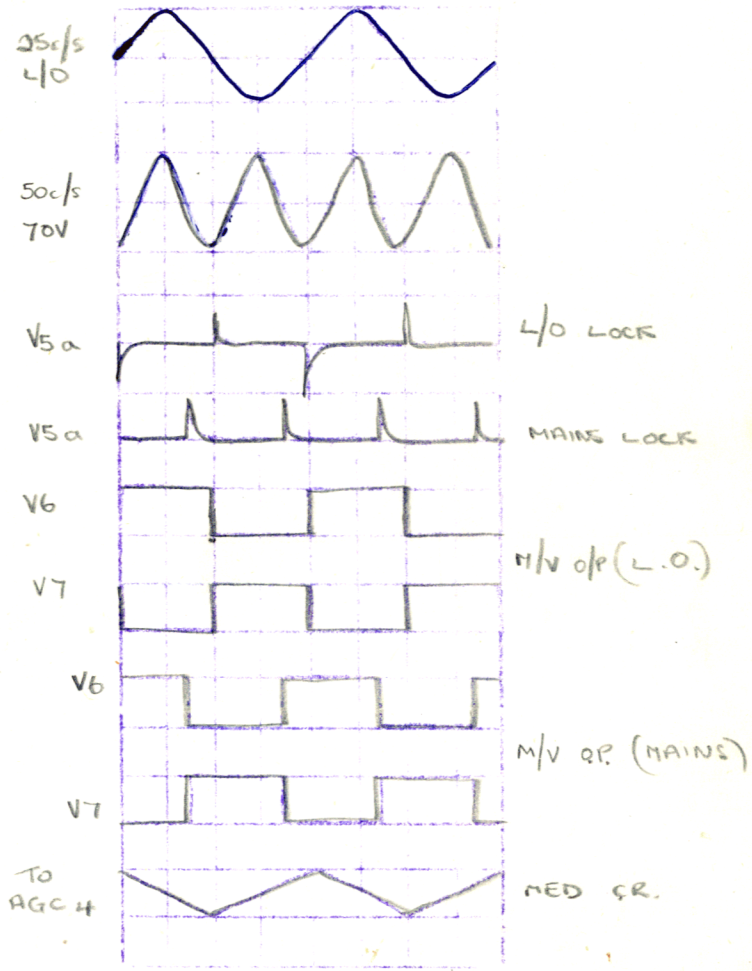
Display
(both Rx & Tx mix gains)

ERM - Position variable at Rx.
STROBE - A bright spot at the foot of the ERM on the IFF trace only.
D.P. - A bright spot on the IFF trace, its position varied from the console.

LK1 PANEL

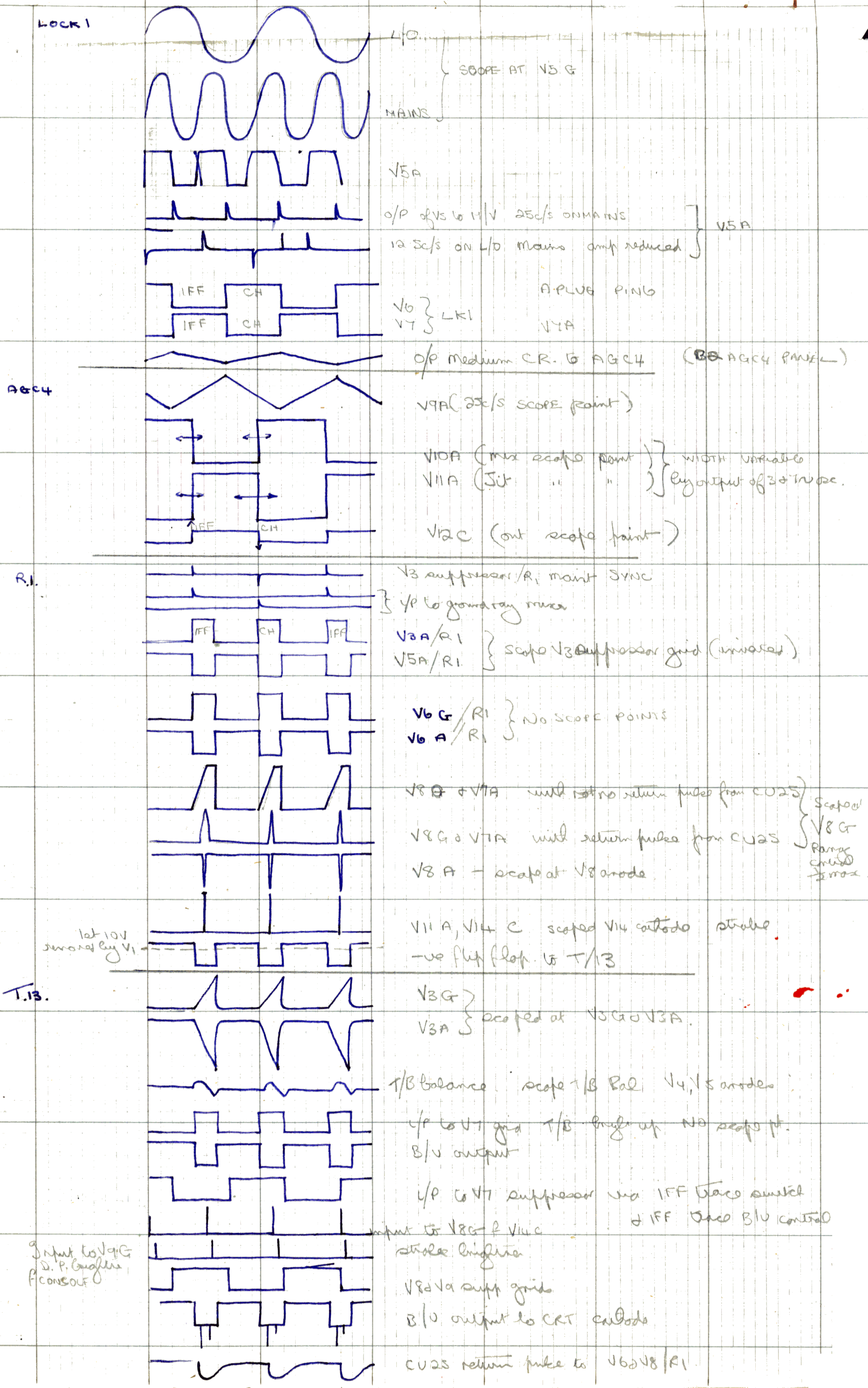






V11
AGC SYNC
P21 250V ANODE

WAVEFORMS


LOCK 1
L/O
SCOPE AT V5 G
MAINS
V5A
O/P of V5 to H/V 25c/s ON MAINS
12.5c/s ON L/O mains amp reduced
V5A
IFF
CH
A PLUG PIN 6
V6
V7
LK1
V7A
O/P Medium CR. to AGC4
(AGC4 PANEL)
AGC4
V9A (25c/s scope point)
V10A (mix scope point)
V11A (Jit " ")
WIDTH VARIABLE by output of 3 & 7N osc.
V12C (out scope point)
R.1.
V3 suppressor/R1 mains SYNC
I/P to ground ray mixer
V3A/R1
V5A/R1
scope V3 suppressor grid (inverted)
V6 G/R1
V6 A/R1
NO SCOPE POINTS
V8 G & V7A with no return pulse from CU25
V8 G & V7A with return pulse from CU25
Scoped V8 G Range control ½ max
V8 A – scope at V8 anode
V11 A, V14 C scoped V14 cathode strobe
–ve flip flop to T/13
1st 10V removed by V1
T.13.
V3G
V3A
scoped at V3G & V3A.
T/B balance scope T/B Bal V4, V5 anodes
I/P to V7 grid T/B bright up NO scope pt.
B/U output
I/P to V7 suppressor via IFF trace switch & IFF trace B/U control
input to V8G & V14C
strobe brighten
Input to V9G D.P. brighten & CONSOLE
V8 & V9 supp grids
B/U output to CRT cathode
CU25 return pulse to V6 & V8/R1

LK1 (cont.) from offside page →)

V9+V10 —ve DCRs V9 to —ve m/v (V6)
V10 to +ve m/v (V7)

V11 — AGC sync mixer

WAVEFORMS — see large sheet ~~at~~, previous page.

Switches

S3	Lock source	Local mains 1 in 1
S4.	Lock to CH Tx	
S5.	MK III IFF	in use not in use
S2.	Lock from CH Tx	OK. U/S.

Controls

(Lead away R's in anodes)
Pre set M/V control
L/O Tuning (in Rcc stages)

RADIO LOCK Bandwidth freq. control (C6 in Diode cathode detector)

Power supplies from P21

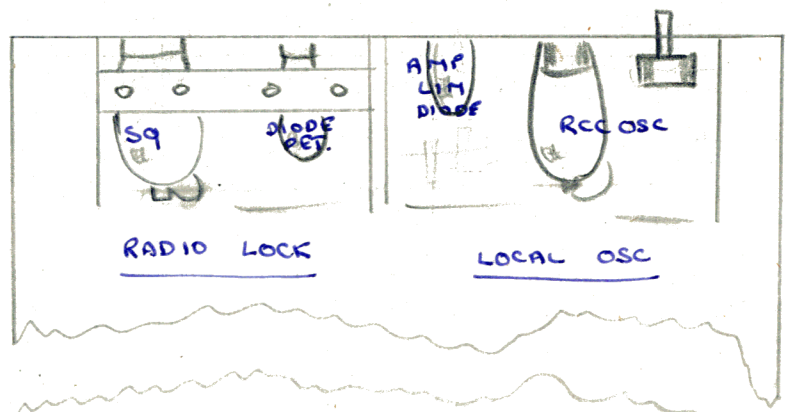
250V	V2 anode	Sq.
	V6 anode	M/V.
	V7 anode	M/V.
	V5 screen	Sq.
250V stab.	V3 anode	Rcc osc.
	V3 screen	Rcc osc.
500V	V5 anode	Sq.

Scope pt.

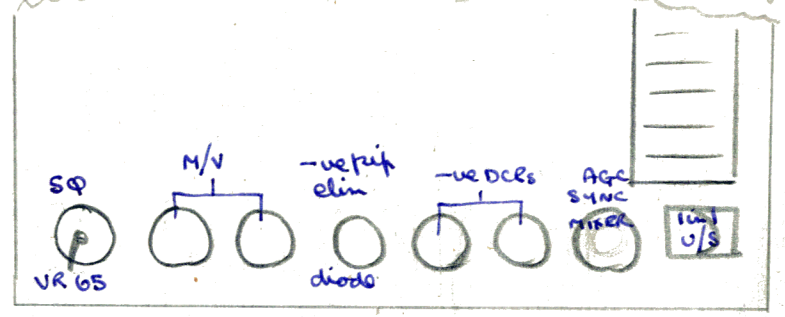
V2 anode	——	G/K from Tx
V3 anode	——	~ 25/s
V5 anode	——	Light of ||| from ⊓⊓⊓
V3 ~~anode~~ grid	——	⊓⊓⊓⊓

V7 anode —— ⊓⊓⊓
V11 anode —— ⊔⊓⊔

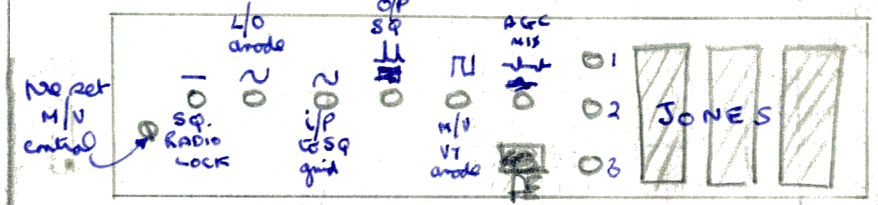
LAYOUT (LK1)



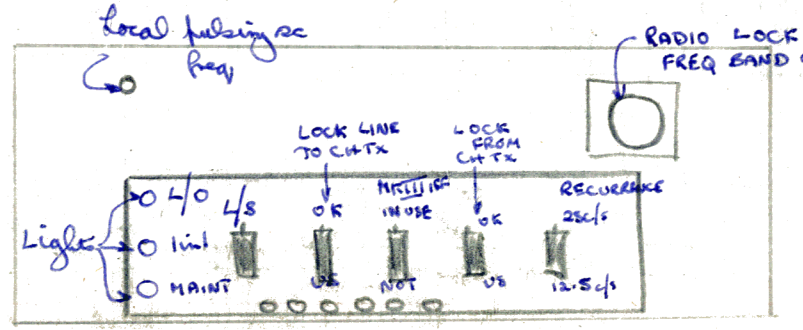
PLAN



REAR



FRONT



LK1 Panel.

Block Diagram: — see previous pages

Purpose:

1) ⎍ to fire CH Tx (via AGC4)
   " " IFF " "
2) ⎍ suppress CH signal Rx during IFF periods
   " IFF S/U and console
3) ⎍ trace sep CH Rx
   " " console
   suppress D/P console
   " IFF Rx during CH periods
   " S/U ERM strobe and D.P.
4) accepts locking from Tx by radio link if land line faulty.

Action: AMES Type 1 as a whole is locked by a 25 c/s square wave generator in LK1. In turn this Sq. wave is initially trigd. from :—

(a) 1 in 1, intended to be a common locking source of all CH stations as a whole to be independent of 50 c/s grid mains and its freq drift. This source is not used because of certain technical difficulties.
(b) 50 c/s mains is usual source
c) An emergency locking oscillator is used in LK1 if mains fail

V_1 & V_2 Radio reception of CH Tx GroundRay if land line fails. S2 connects R/L to CRM mixers and H.T rectifiers.

Lock source switching S3

S3 1 in 1: Provided S_4 is OK lock to V_5 is from 1 in 1. If 1 in 1 fails relay automatically transfers lock to "local" overriding lock source switch.

MAINS: If lock source is in any other position and lock line from CH Tx goes U/S. S_3 is overriden and V_5 takes mains lock

LOCAL: Lock from local osc providing S_4 is at OK.

Locking Summary

S_4 [Lock to CH Tx] at "OK" either S_3 a) 1:1 not used
b) mains-normal
c) local from V_3
} all via LK1 & AGC4

at "U.S" R3016A locked by GroundRay of CH Tx } via V_1 & V_2 of LK1

S5 MK. III IFF "IN USE" connects land lock line from IFF Tx to R1/V_1

"NOT IN USE" R1 takes trigger pulses from AGC4 [object to display director pulses]

LK1 V_3 L/O frequency is around 25 c/s but should not be set exactly to this in order to minimise interference to other stations on chain.

V_4 a form of AGC for V_3 to maintain constant amplitude of L/s emitted

V_5 is a normal squarer.

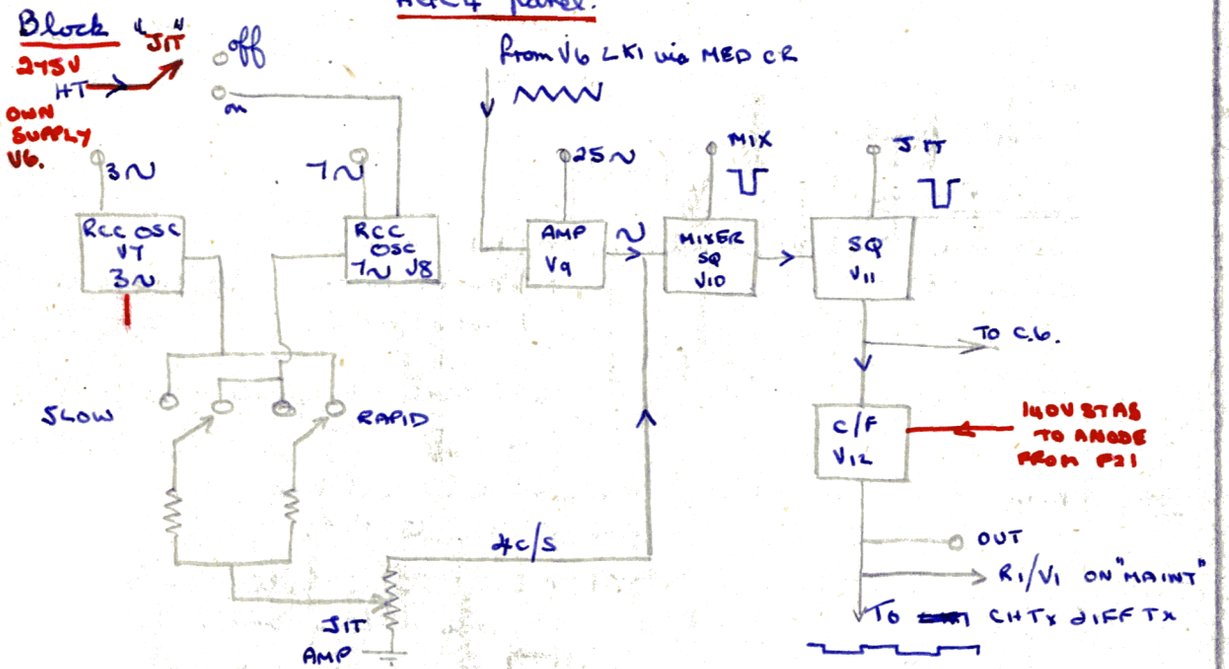
V_6 & V_7 Free running M/V should be set somewhat slower than 25 c/s it can then be synced. by 25 c/s sync pips from V_5 and will run locked at 25 c/s. Necessary for —ve sync. pips on 50 c/s to be eliminated to avoid uneven running of M/V so —

— V_8 does this on mains for 25 PRF and also for ~~25~~ L/O as well, on 12.5 c/s P.R.F.

N.B. On mains lock at 25 PRF M/V freq. divides by 2 and on 12.5 PRF divides by 4.

12.5 c/s PRF minimises effect of ionosphere scatter. Scatter returns from about 4,000 mls. ie 45 m secs. 25 PRF gives 20 m secs between traces ie scatter is on alternate traces, whereas 12.5 c/s has 80 m secs between traces and does not display scatter

AGC4 panel.



AGC4 purpose:

1. Gain reduction for first 30 miles of trace
2. Triggering pulses for CH and IFF Tx's
3. Jitter triggering and spacing during hostile interference locked at 25c/s

ACTION

IJAJ Pulses which fire Tx ~~are given~~ and start timebase are given non-linear spacing whilst retaining retaining 25c/s P.R.F. Successive traces jitter irregularly but our own Ground Echo appear stationary whilst jamming pulses appear to jitter on trace.

V7 & V8: provide a source of irregular bias for V10 ∴ delay on LK1 sq wave is now irregular

AGC 4 ~~test~~ (cont.)

V10 produces sq. wave which is lagging in phase relative to LK1 sq wave. Tx's are fired by AGC4; muting of Rx's is obtained from LK1 sq wave. Hence corresponding Rx has had time to recover from muting after Tx fires whilst the other Rx remains muted.

V11 Further squaring and amplifn producing a very sharp sided sq wave

N.B. (a) V10 & V11 both have very short grid bases

(b) CH Tx fired on −ve going edge

IFF Tx fired on +ve " "

WAVEFORMS:— see large sheet previously drawn.

CONTROLS:

Variable resistors in grid of both osc. vary frequency

"SLOW RAPID": By switching in either 150K or 300K resistors into the outputs of either values (3c/s & 7c/s) the amount of 3c/s to 7c/s and vice versa which are mixed together can be varied. If the amount of 7c/s is greater then jitter becomes faster since it is in varying more quickly. 4c/s output is varied in amplitude by the potentiometer:-

"JITTER AMP" before it reaches the Mica grid.

SWITCHES "JIT ON OFF" switches H.T. to RCC oscillators.

SCOPE PTS.

"25c/s" Anode of Amp V9 — 25c/s
"MIX" sq V10 — ⊔
"7c/s" anode V8 — sine 7c/s
"JIT" anode sq. V11 — ⊔
"o/p" ~~cathode~~ c/f V12 — ⊓⊓
"3c/s" anode 3c/s V7 — ∿ 3c/s

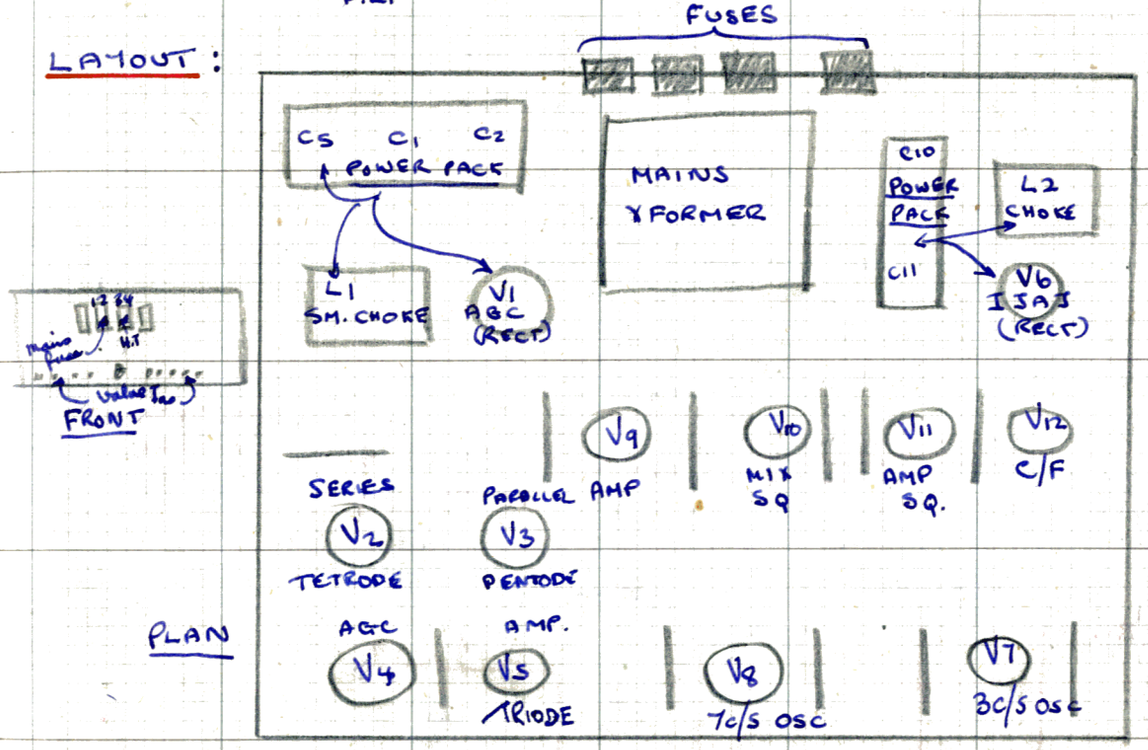
POWER SUPPLIES:

Both AGC and ISAJ in AGC4 have their own power unit. V6 supplies ISAJ with 275 Volts. The c/f has supply from P.21

275V V6. { V7, V8, V9, V10, V11

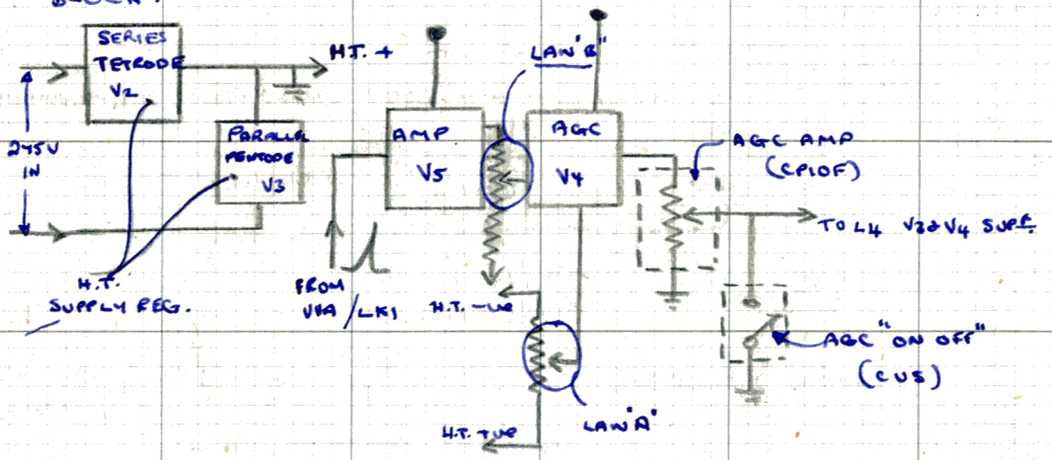
140V STAB P.21 { V12

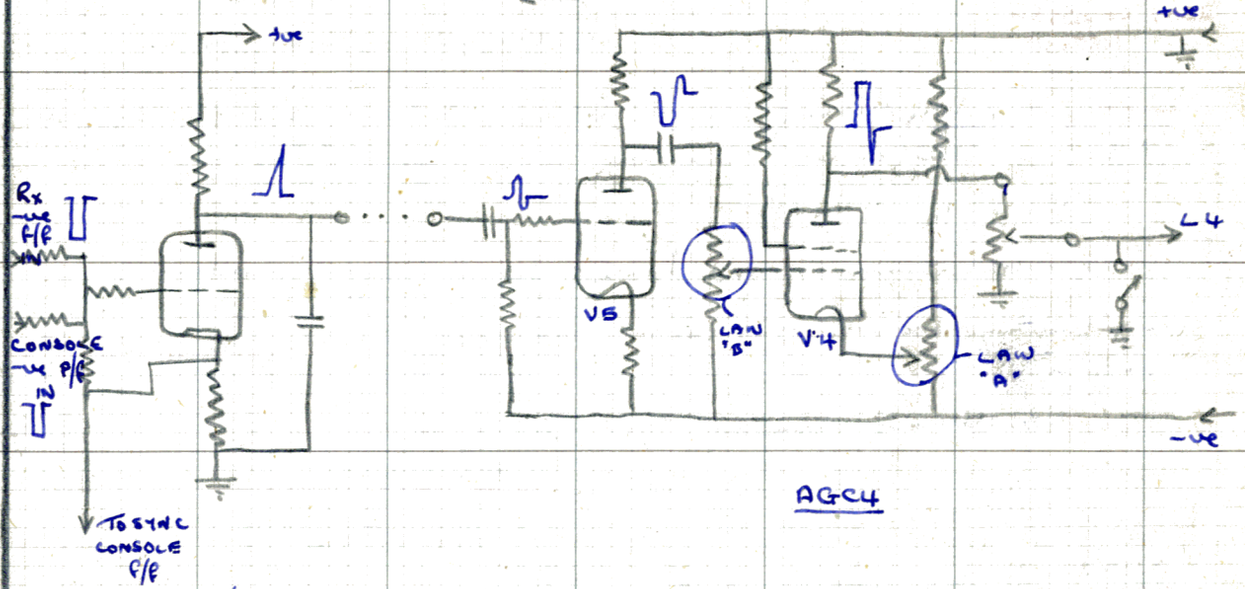
LAYOUT:



AGC

BLOCK:





AGC4

V11/LK1

WAVEFORMS: See ~~after~~ AGC4 page.

CONTROLS:

[AGC4 REM] "LAW B" varies amplitude of output to grid V4 AGC

"LAW A" varies cathode bias of V4 AGC

(CP10F) "AGC amp" " output of V4

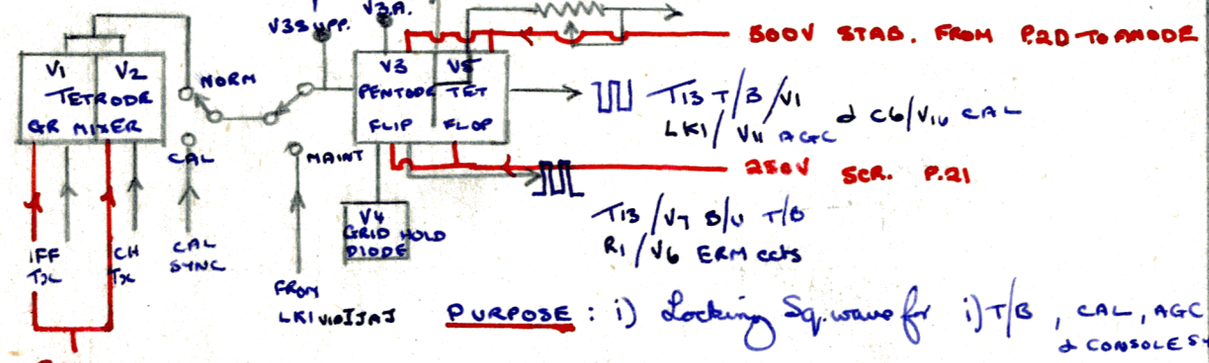
(CU5) "AGC ON/OFF" When AGC on "OFF" shorts AGC to earth

P.T.O.

R1 Panel.

I

BLOCK DIAGRAM. [STROBE]



PURPOSE: i) Locking Sq. wave for i) T/B, CAL, AGC & CONSOLE SYNC
ii) CH & IFF ground ray mixing
iii) Electrical range marking (coastal)

ACTION Ground Ray mixing: V_1 & V_2 between pulses are cut-off by (grid) cathode bias. They conduct alternately when CH and IFF T_x's fire.

Flip flop V_3 V_4 & V_5

V_4 diode eliminates grid positive flip at V_3 grid and prevents V_3 grid running ~~too~~ into grid current and thereby reducing squareness of waveform.

N.B. Alternate sources of SYNC (a) Calibration
(b) Maintainence

On these syncs. there is no IFF w/form or trace

WAVEFORMS: See previous notes

CONTROLS (R1) "~~RANGE~~ WIDTH": varies ~~bandwidth~~ aiming pot on grid flip thereby width of T/B B/U pulse. ie time when flop cuts on.

SWITCHES (OPIDE) "RANGE SWITCH": energises the AOB relays which puts and changes condensers in V_3 grid according to required range 200 170 & 30 mls

170 & 30 } AOB energised
200 " deenergised

NOTE AOB relays are also in T/B

"CAL MAINT & NORM" — [SYNC SWITCH] (LK1)

Switches in C & D relays which select the required conditions

"NORM" — Ground ray sync
"MAINT" — sync from LK1
"CAL" — sync from cal markers in C6
} applied to V_3 grid (Receiver flip)

SCOPE POINTS

V_3 SUPPRESSOR
V_3 ANODE

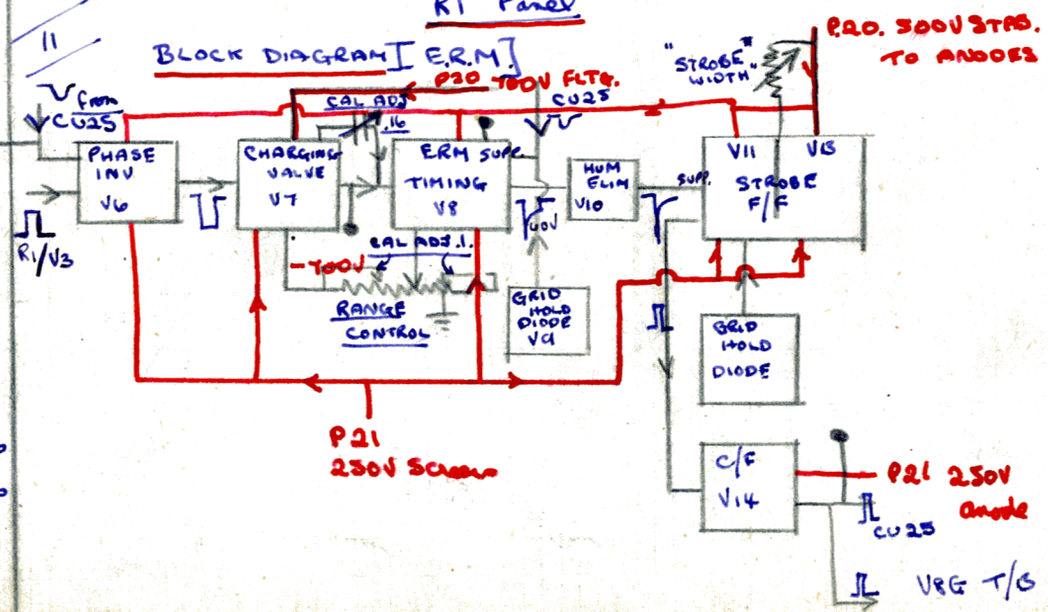
POWER SUPPLIES

P21. 250V { V_1 anode & Screen; V_2 anode & Screen
P21 250V { V_3, V_5 } Screens
P21 500V STAB { V_3, V_5 } anodes

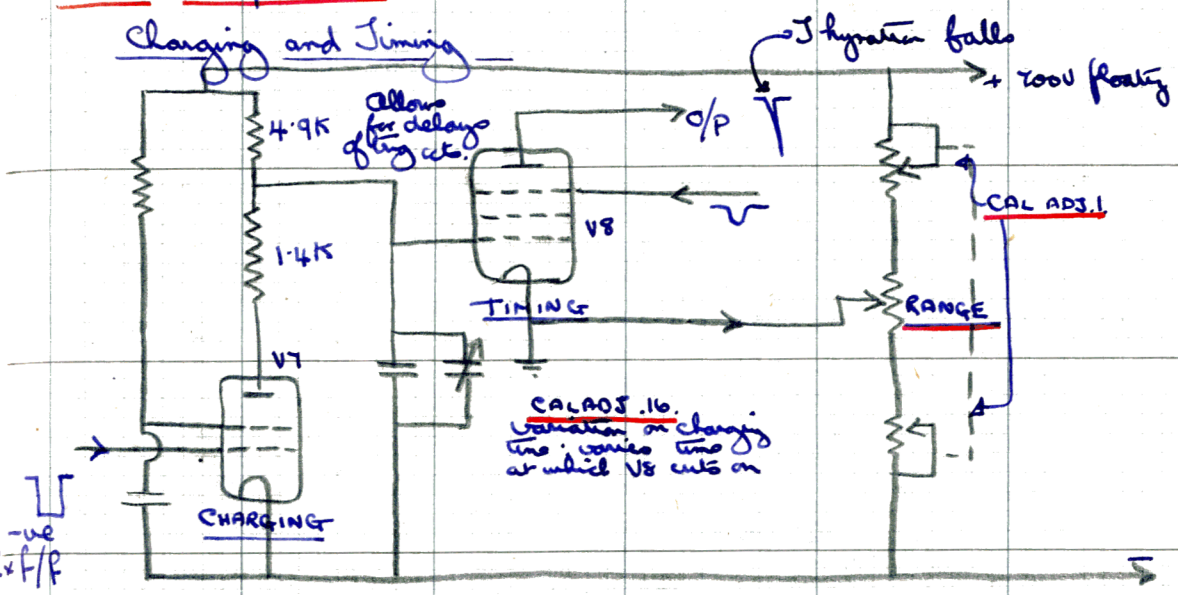
II

R1 Panel

BLOCK DIAGRAM [E.R.M.]



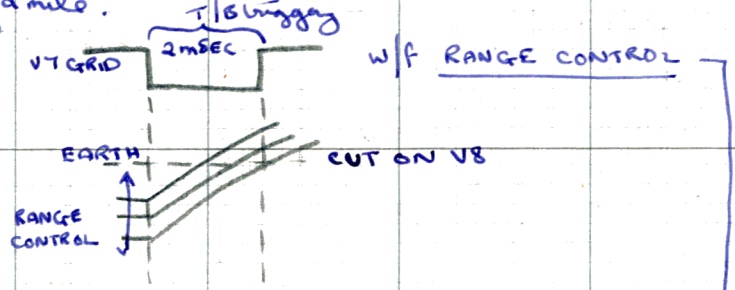
ACTION E.R.M. production:



The +ve flip flop sq wave inv by V6 applied to trigger V7 control grid [V7 conducting producing at anode a voltage which applied to V8 control grid holds that valve "cut off"] The now negative sq. wave cuts of V7 whose anode voltage rises, the rate of rise retarded by the need for charging the anode condenser. When the voltage between grid and cathode of V8 is sufficient to overcome the bias, V8 conducts producing in its anode a waveform whose leading edge is now an exponential. That leading edge triggers the stable f/f whose +ve output after shortening is used to trigger a thyratron [CV25] the resultant waveform in anode of thyratron is a pip whose leading edge is very fast. Also a return is taken from the thyratron anode to cut off V8 (R_1) on its suppressor grid and hold it cut off for a length of time which exceeds the T/B time since that pulse is also applied to hold V6 cut off. The result is a very narrow pip whose position within the T/B triggering sq. wave depends on
(a) the bias between V8 grid and cathode
(b) Value of anode condenser.

Extra gen
ERM measures range accurately without using cals markers and it is independent of linearity of T/B. Calibrator is only used.
(a) To initially calibrate ERM.
(b) If ERM fails.

ERM is electrical stop watch, correct to 3 u sec, which is started when Tx fires and stopped by setting of range control. At instant of stopping it gives RM pulse which forms an electrical pointer. Range accuracy + $\frac{1}{3}$ of a mile.



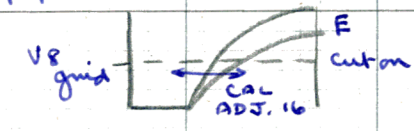
WAVEFORMS: SEE PREVIOUS PAGE & ABOVE

CONTROLS:

(CP10G) "RANGE CONTROL" alters the exponential rise at V7 anode which eventually cuts on V8. Actually in V8 cathode across 100 volt

(CP10H) "CAL ADJ 1" has similar but finer effect than "RANGE" used to compensate for zero errors. First cal pip should be on red line. In series with range control.

(CP10H) "CAL ADJ 16": Effect is to compensate for variation in time constant circuit between V7-V8. Set red line to 16th cal pip. Varies condenser in anode of V7 charging valve.



"STROBE WIDTH": Varies resistor in grid of V11 (flip of stable f/f) this time at which flop cuts on.

SWITCHES:

SCOPE PTS.

V6 SUPP
V7 ANODE
V8 ANODE
V8 CATHODE
V14 CATHODE

R1 Power Supplies

P21 250V { V6, V7, V8, V11, V13 } SCREENS
V14 ANODE

P20 700V FLG. { V7

P20 500V STAB. { V6, V8, V11, V13 } ANODES

V10, 11 12 13

15-30 μsec FLIP/FLOP used to trigger

(a) Strobe B/U

(b) Generate ERM pulses on CU 25/V1 Thy

(c) Also used in console

700V ⏚

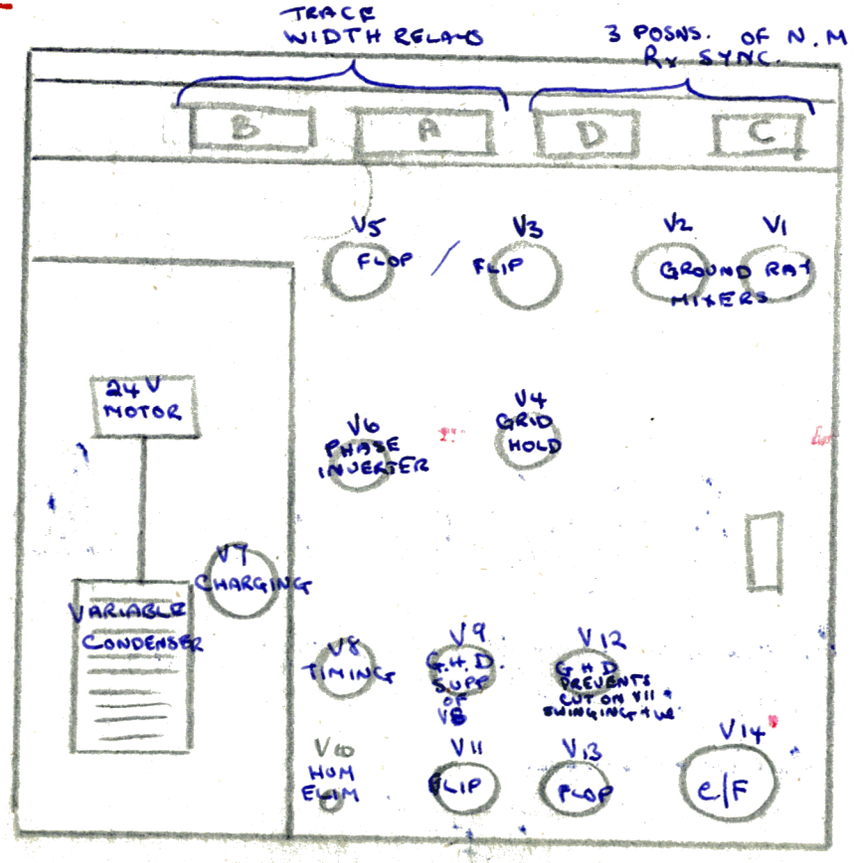
E PLUG BOARD COAX OUTPUTS

JONES

RANGE WIDTH

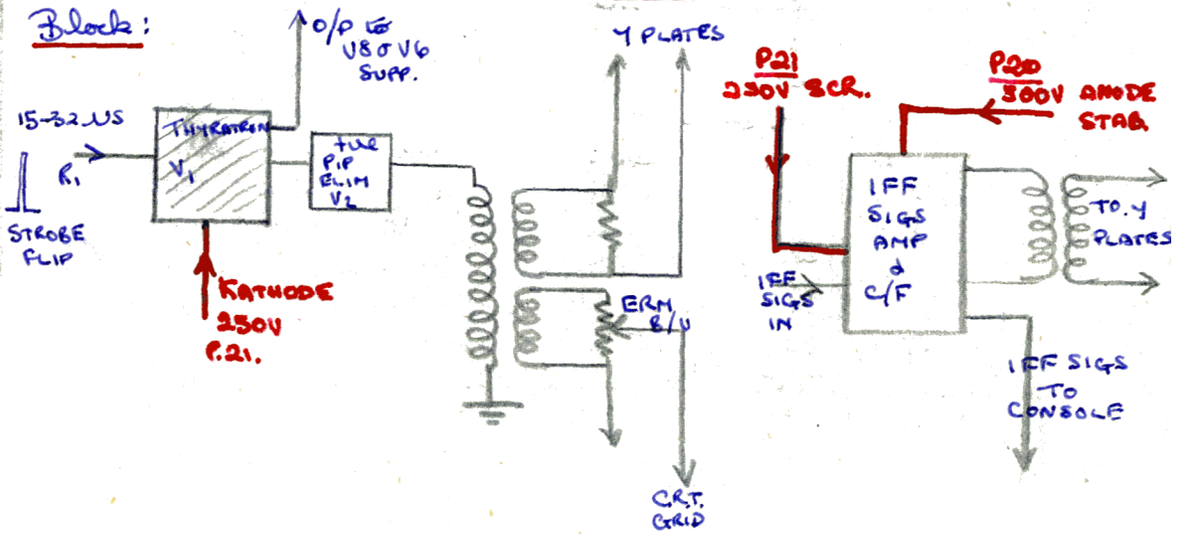
STROBE WIDTH

LAYOUT:



CU 25 Panel

Block:



PURPOSE: a) To help in the production of ERM i.e. produce -ve pulses for supply of V6 & V8.
b) IFF sig. amp. Amplifier takes off feed to Y plates off X former in anode circuit.

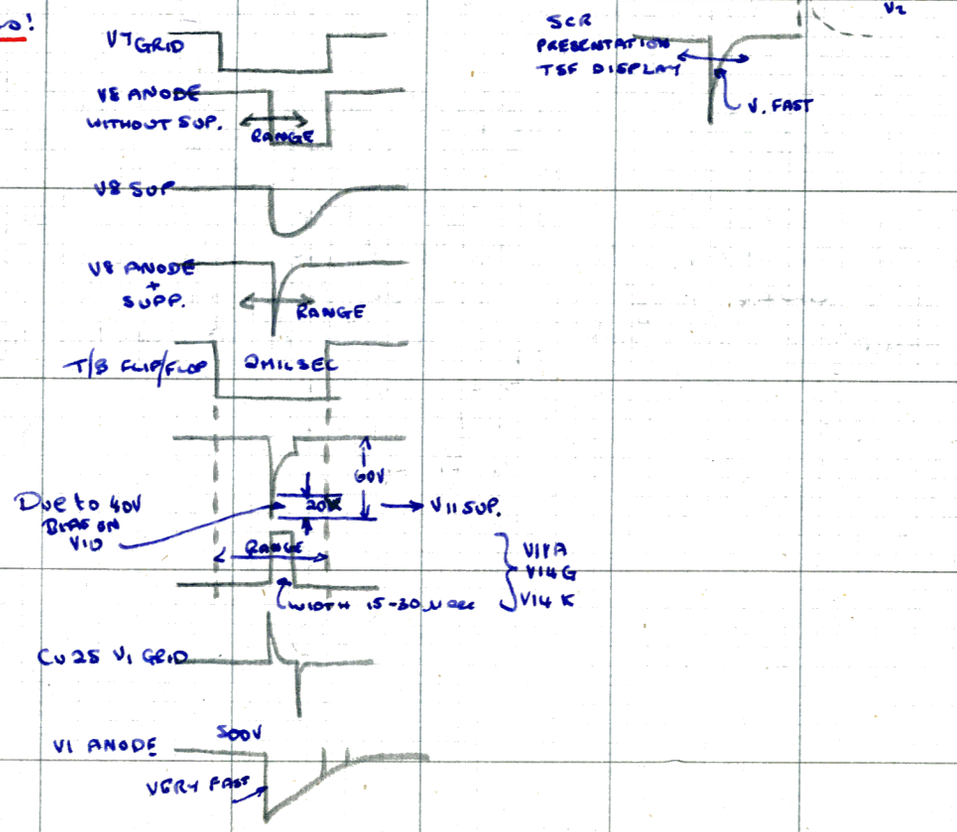
REASON: a) (cont) This ensures (a) Only one RM per pulse
(b) Sharpness of V_8 anode w/form
(c) Prevents V_8 running into excessive grid current

ACTION:

V1 The positive pulse from the C/F is SCRd and +ve cuts the thyatron on and a negative going pulse is developed in the anode which is fed to V6 + V8 suppressors slowly rising exponentially.

V2: For a +ve pip eliminator

Waveforms:



CONTROLS: "ERM B/U" varies resistance across secondary of X former in +ve pip elim load. The output to CRT grid is therefore varied

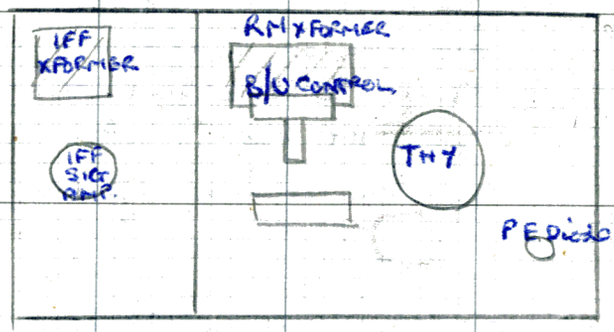
SWITCHES:

SCOPE PTS.:

POWER SUPPLIES:

P21. 250V → V1
P21 250V → SCR. IFF SIG AMP
P20 300V STAB. → ANODE IFF SIG AMP

LAYOUT:



IFF SIG AMP ACTION + CONTROLS:

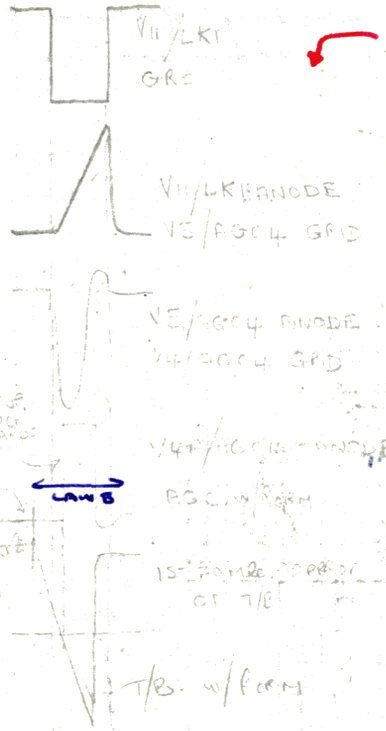
The sigs from IFF receiver are applied to grid of V3 via centre tap on grid coil. They are applied after amplification to X former in to anode and thence to Y plates. There is also another output to console from cathode.

SWITCH: In screen of valve circuit IFF ON/OFF.

POWER SUPPLIES: As above.

LAYOUT: See above diagram.

AGC 4 (Cont.)

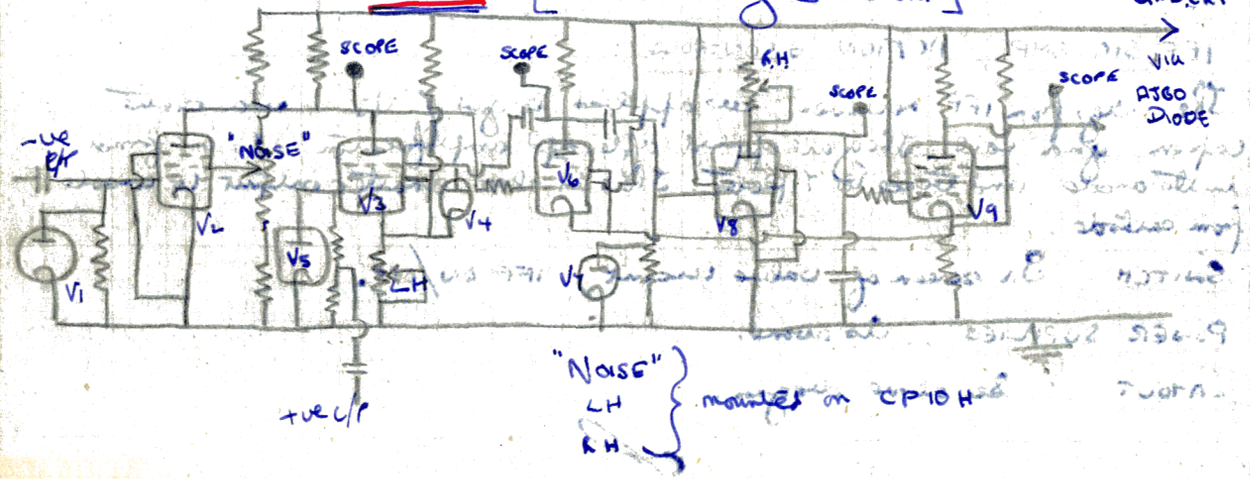


WAVEFORMS:

ACTION: V1 V2 & V3 full wave rectifier producing 275 volts after passing through the regulator circuit comprising V2 & V3

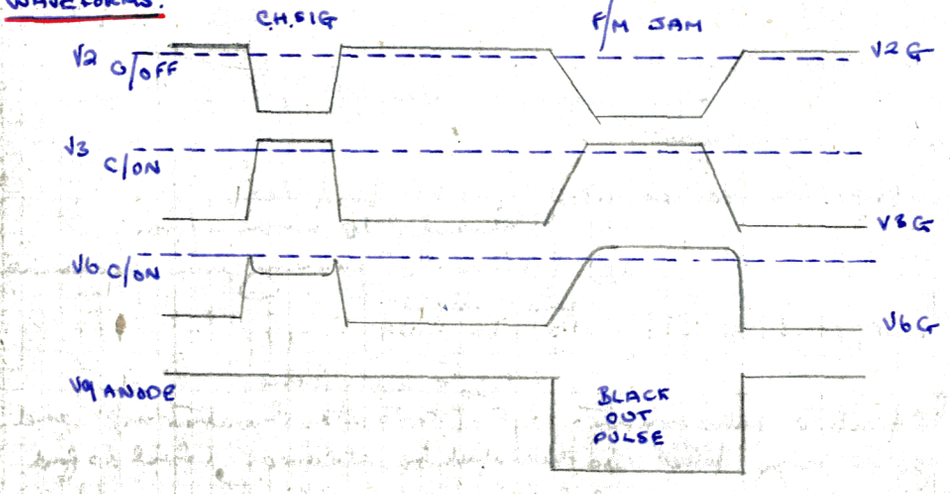
V8 receives +ve going saw tooth from V11/LK1 and amplifies and inverts it before applying to V4 grid via "LAW B" potentiometer which controls the amount of sawtooth to be squared. V4 normally conducting holds suppressor grids of 3rd & 4th I.F. at potential -ve to earth determined by conduction of V4 set by "LAW A" potentiometer. The sawtooth squared +ve going at V4 anode takes the IF's suppressor towards earth potential thus increasing their gain. H.T. +ve is earthed so that suppressor grids do not have high D.C. potential on them.

AJ 80 [Anti Jamming Blackout]



"NOISE" L.H R.H } mounted on CP10H

WAVEFORMS:



ACTION:

PURPOSE: To black out the portions of the trace distorted by frequency modulation jamming to reduce the fatigue of the operator.

ACTION: V2 normally conducting; V3 cut off the output of the signal chain applied -ve to V2 +ve to V3 Biasing arrangement so that V2 cuts off before V3 cuts on. For fast rising waveforms this time is small But for v/f whose rise is slow by comparison the time when both V2 & V3 are cut off is long allowing common anode to reach a voltage sufficient to cut on V6 V6 anode is coupled to V3 suppressor thus holding V3 cut off for the duration of the pulse even though V3 grid may have passed its cut on biased point. The output of V6 is applied to V8 for amplification thence to V9 which produces -ve going blackout pulse for application to CRT grid.

Should long spikes of noise or CH signals be of sufficient amplitude to eventually cut on V6 the anode C.R. of V8 discriminates between these and jamming by testing towards long CR for noise and signal and shorter CR for frequency modulated jamming (wide in time) thus V8 anode does not rise to a potential large enough to cut on V9. Whereas for the wider jamming pulse

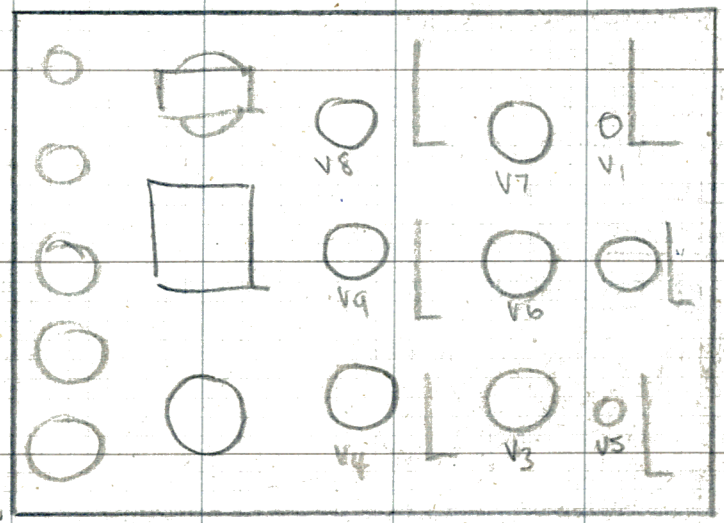
V9 does cut on.
V1 grid Rold diode (-ve).
V5 " " " (+ve)
V4 Sup " " " (-ve)
V7 grid " " (-ve)

POWER SUPPLY:
Self contained [from regulated mains] of 275 volts H.T

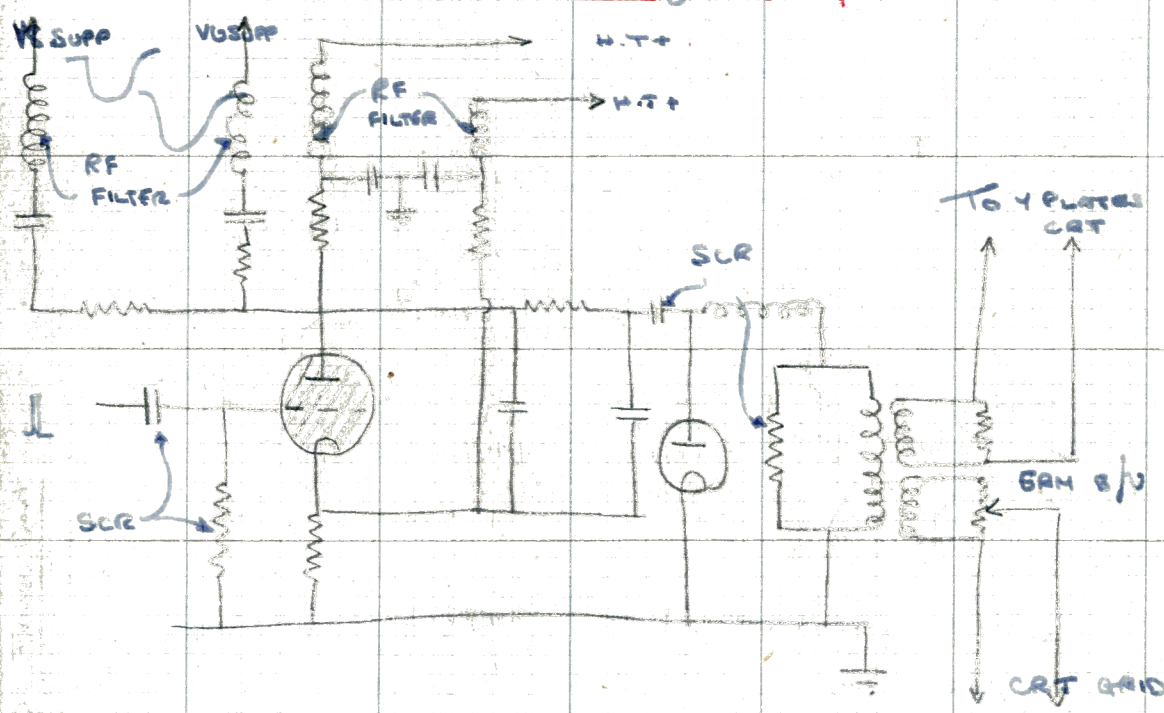
CONTROLS (CP10 H)
- "NOISE": Screen of V2 varies voltage on Rame and therefore noise [greater voltage greater noise]
- "L.H.": Varies bias on V3 thus turns when it cuts on and off. Cathode of V3
- "R.H": Anode of V8 varies amplitude of output

SWITCHES

LAYOUT

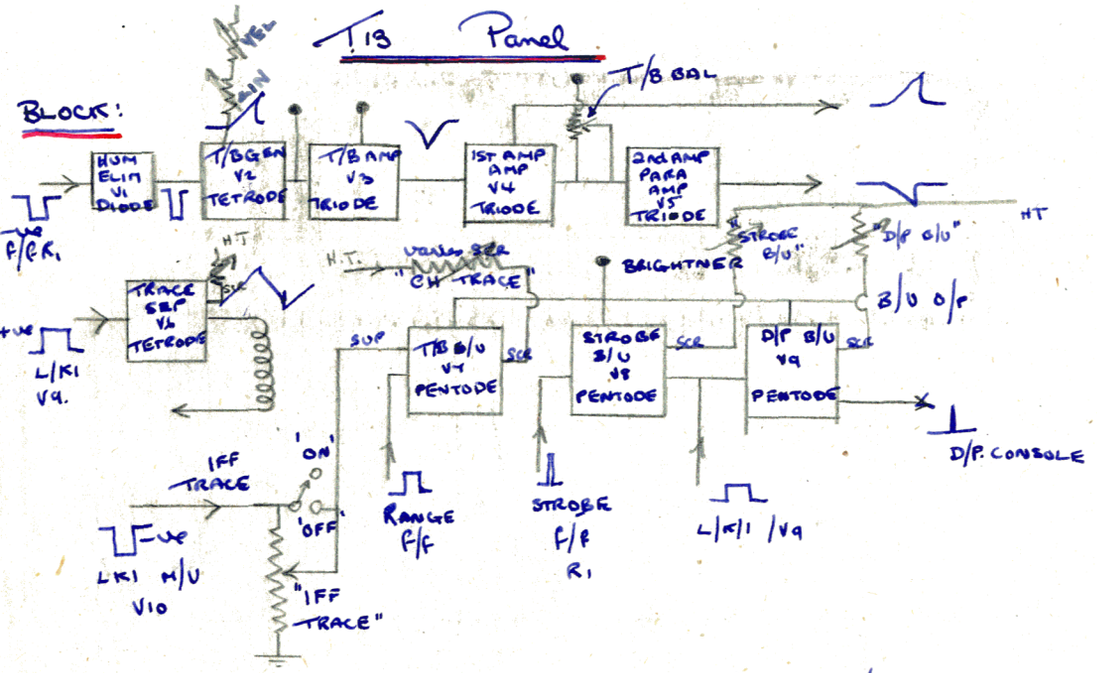


CV23 Circuit diagram



T.13 Panel

BLOCK:



ACTION: V_1 Removes first 10 volts approx of the flip/flop triggering pulse Cathode biased 10 volts +ve. The hum picked up and occurs between flip flop cycles.

V_2 Timebase generator of the amplo type the value changing selected anode and screen condensers for the different ranges. Relay selection (A) energised for 10 mks

(B) " " 130 mks.

neither energised for 200 mks.

CONTROLS: "LIN" varies charging rate of anode C. Sn anode of V_2 on 200 mk ONLY "FINE" varies ganging pot. of both condensers. Disc filter

V_3 amplifies

V_4 } Parathase amplifies providing balanced outputs to
V_5 } C.R.T. X plates. T/B balance control adjusts grid cathode feed of second valve to balance its output to that of the first

V_7 T/B brighten CH trace brilliance varied by potentiometer in screen circuit; IFF trace brilliance varied by ~~potentiometer~~ application of the whole or selected portions of the -ve m/v sq wave from L/K1 on the suppressor grid.

CONTROLS: "CH Trace", "IFF Trace", "IFF Trace" switch – see diag

"Strobe brilliance" varied by potentiometer in the screen circuit valve being cut off during CH periods. V_8

"D/P brilliance" varied by pot. in screen of V_9 valve cut off during CH period. ~~B~~

V_8: Strobe brilliance varied by potentiometer in the screen circuit valve being cut off during CH time period by multi/vib sq. wave which is negative going during that time.

V_9: D/P brilliance by varying screen potential cut off during CH time period by M/U output which is -ve during that period. D.P. is generated in console type 3 and is fed to trigger V_9.

WAVEFORMS:

See previous page

CONTROLS: see note in ACTION ALSO "TRACE SEP" Varies SCR V_6 (T.13.)

SWITCHES: " " " "

SCOPE PTS: V_3 GRID —

V_3 ANODE

"T/B BAL" —

"Brighten" V_7, V_8, V_9 ANODES —

POWER SUPPLIES:

POWER SUPPLIES:

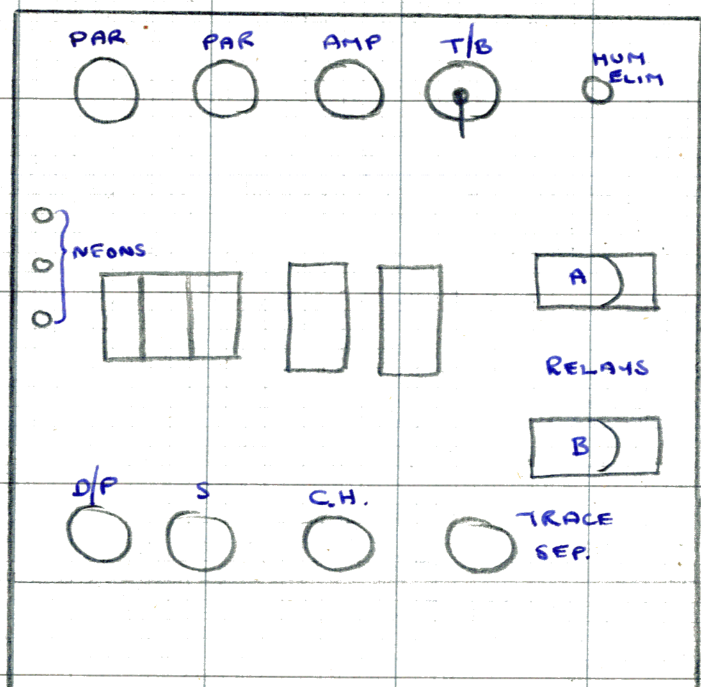
1200 V P20 { V2, ~~V3~~, V4, V5 } ANODES

500V P20 { V3 ANODE

500V P.21 { DEF COILS (TRACE SEP)

250V ANODE & SCREEN P.21 { V.7., V.8., V.9. } ANODE & SCREEN

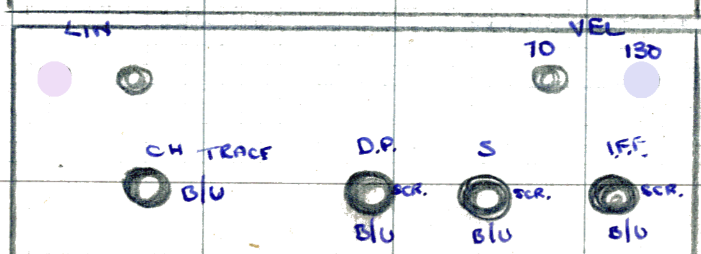
LAYOUT:



T/B C's UNDERNEATH

70 — A energised
200 — but deenergised
130 — B

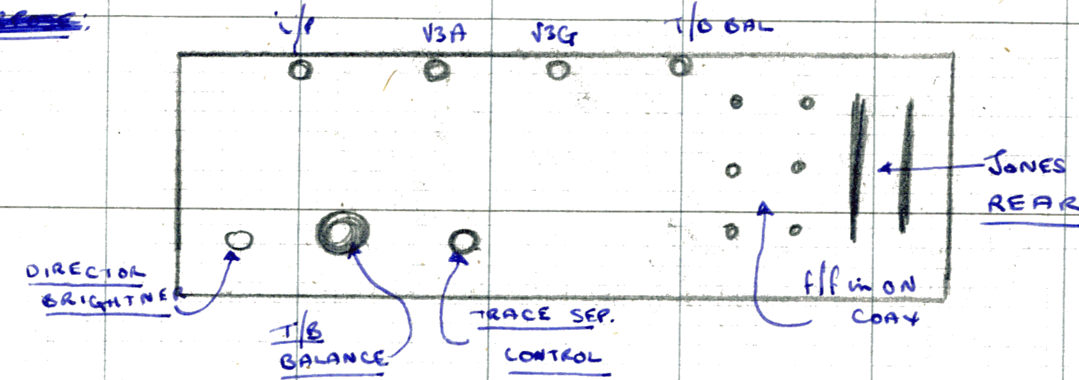
TOP



VEL 200
CP10H

FRONT

~~PURPOSE~~:



PURPOSE:

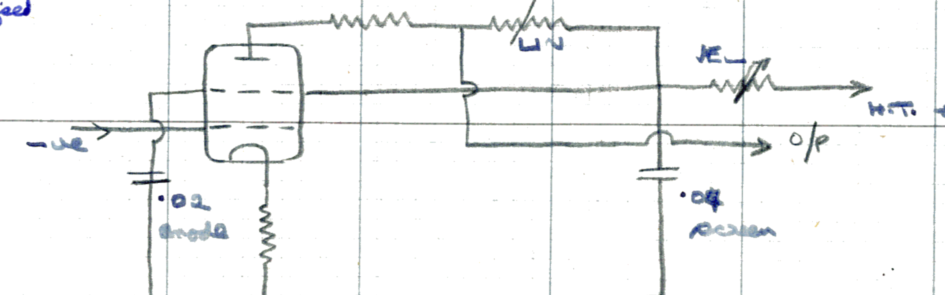
From the past notes it can be seen that the purpose of T13 is.

(a) To provide a T/B

(b) " " Trace separation.

(c) To provide B/U's for strobe T/B & O/P.

EXTRA NOTES T/B circuit



1st valve; Diode receives on cathode -ve sq. wave from flip/flop → grid of second valve [illegible]. Diode clips off first 10 volts of input waveform because during time between f/p pulses hum occurs ∴ hum is removed so that it does not annoy triggering of V_2 or appear on T/B. Cathode biased 10 volts +ve so before it conducts [illegible]

voltage must swing beyond 10 volt -ve.

In T/B gen, amplified T/B gen voltage triode. Relays are energised to provide 200 mls T/B. Cct. envelope itself in to above diagram.

-ve going sq. wave cuts off valve — anode and screen rise to H.T. Put condensers rise through resistance network. anode C·01 μF screen ·04 μF. They charge at different rate. Total charging rate governed by CR's i.e resultant is a fairly straight line charging rate. at the end of sq. wave, valve conducts and shorts out condensers.

One velocity control for each of the ranges it varies timing pot of both condensers i.e varies charging rate of anode condenser

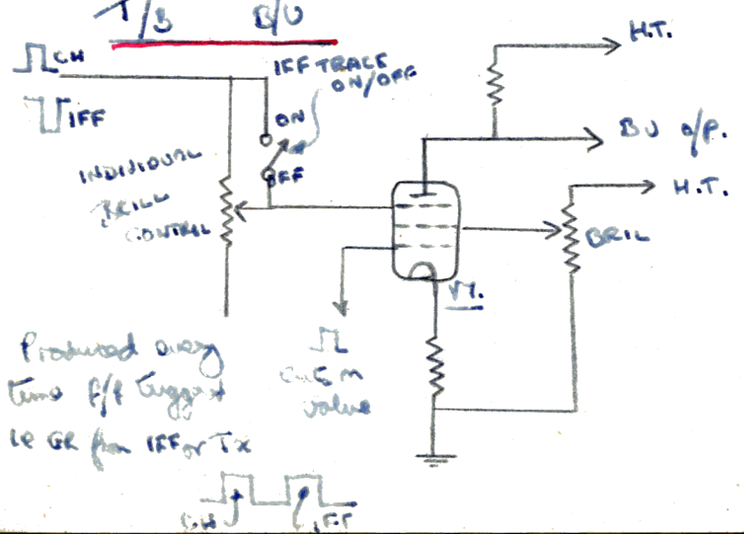
Relays employed for changing of resistance value this is removed by alone to be replaced by two fixed resistors.

Screen screen circuit Co are reservoir, purpose, to protect Co in a tendency to overcharge i.e. using a 10 mls. T/B an input square wave sufficient to produce a 1000 mls. T/B i.e it is wider

V3 is T/B amplifier

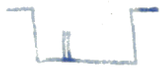
V4 & V5 Para amps as described

T/B B/U



Strobe B/U V8

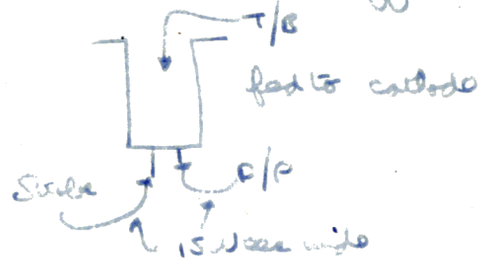
Same except that trigger i/p comes from F/F in R_1. Occurs in range flit float tubes



Strobe occurs everytime with ERM. Anodes of B/U's are strapped together and have a common load ∴ outputs are mixed and result is as follows

During CH time period strobe must be put away as once M/U is used. The IFF to suppress V8, it cuts on and produces a +ve output pulse. Only when IFF trace being displayed.

D/P B/U V9 again a portion D.P. produced in anode T3 fed to control grid and is a very narrow sq. wave. During CH time period V9 must be cut off so that D.P. is not showing



C6 PANEL.

PURPOSE: To provide narrow I wave col pulse to cut off T/B during its time period.

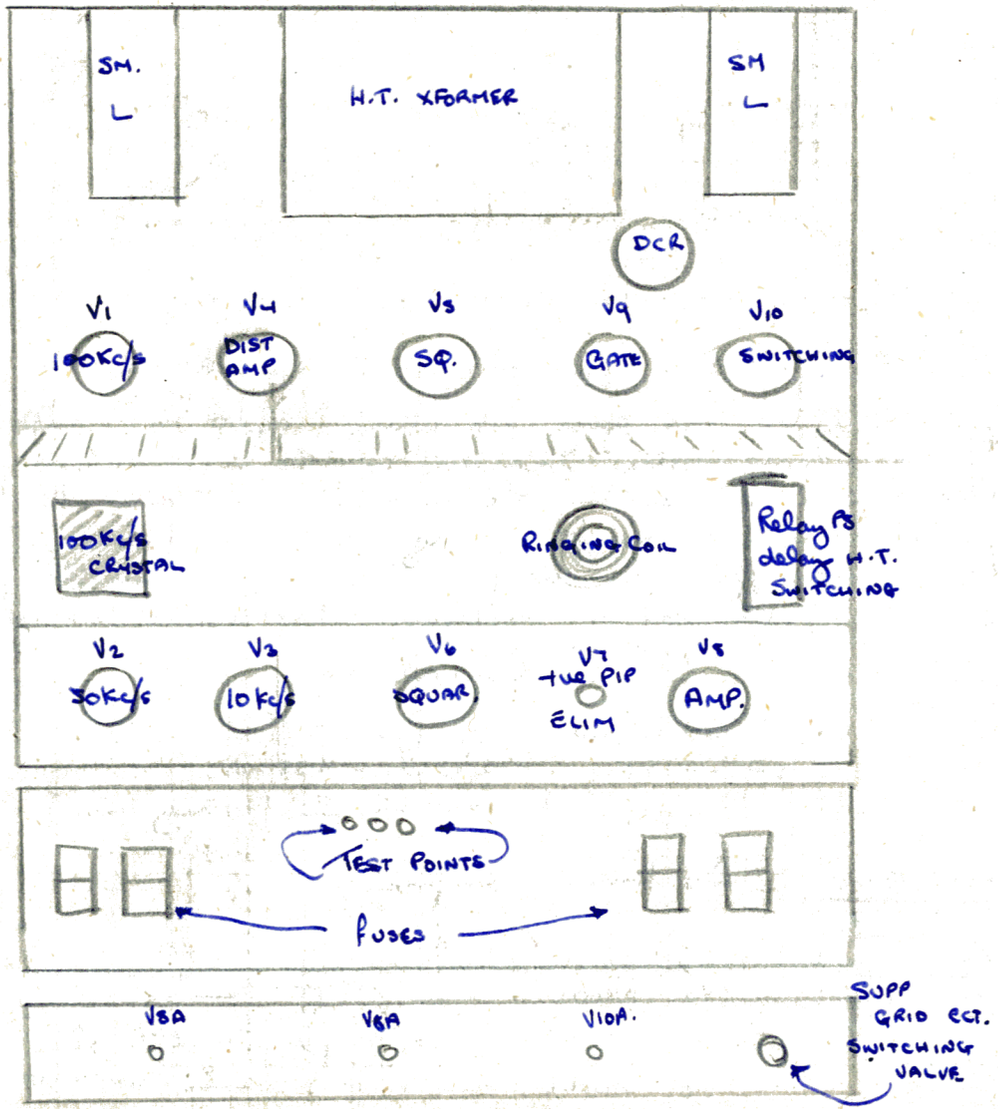
C6

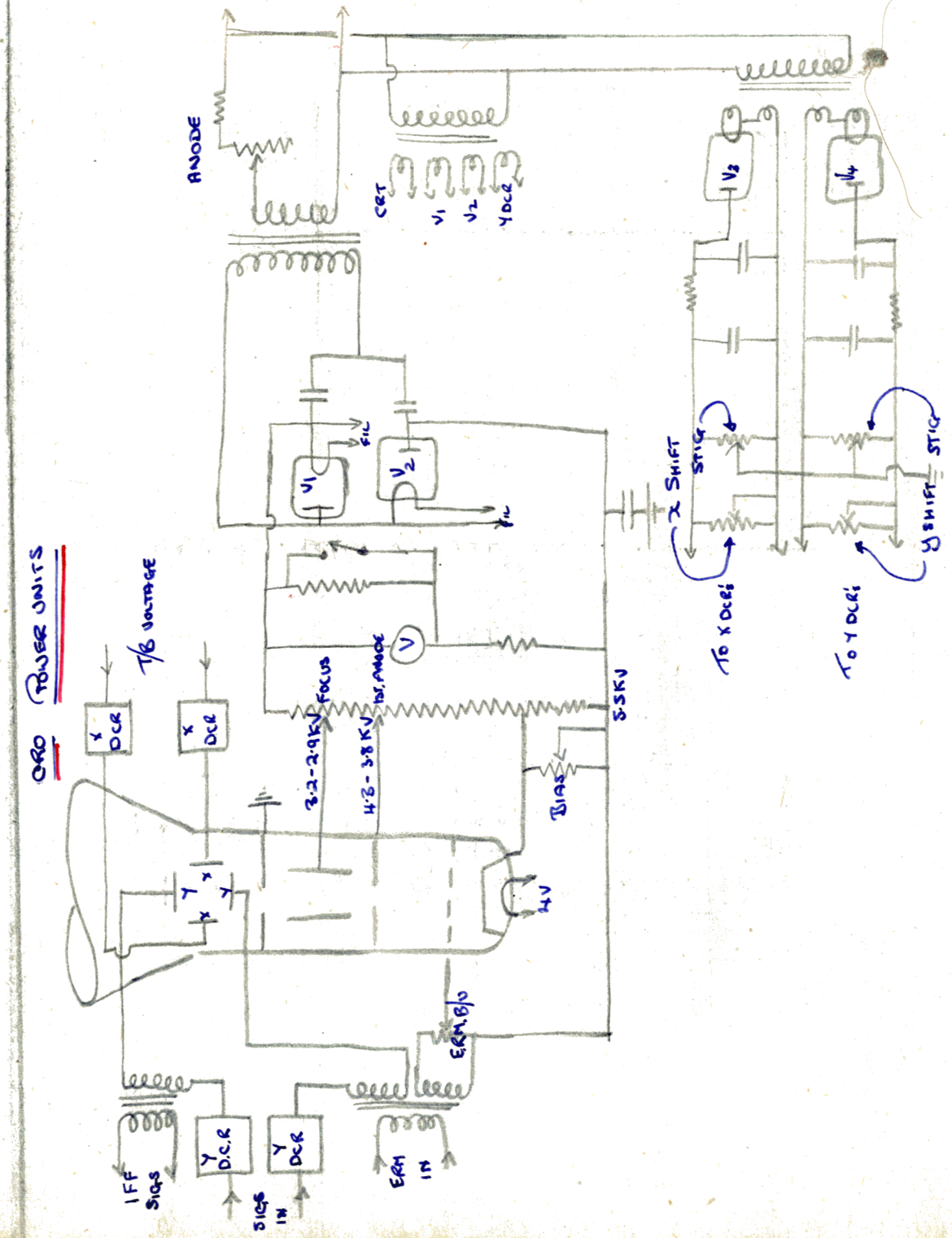
POWER SUPPLIES:

P21 500V { V6. ANODE

OTHERWISE C6 HAS ITS OWN POWER H.T. off 250 VOLTS

LAYOUT:

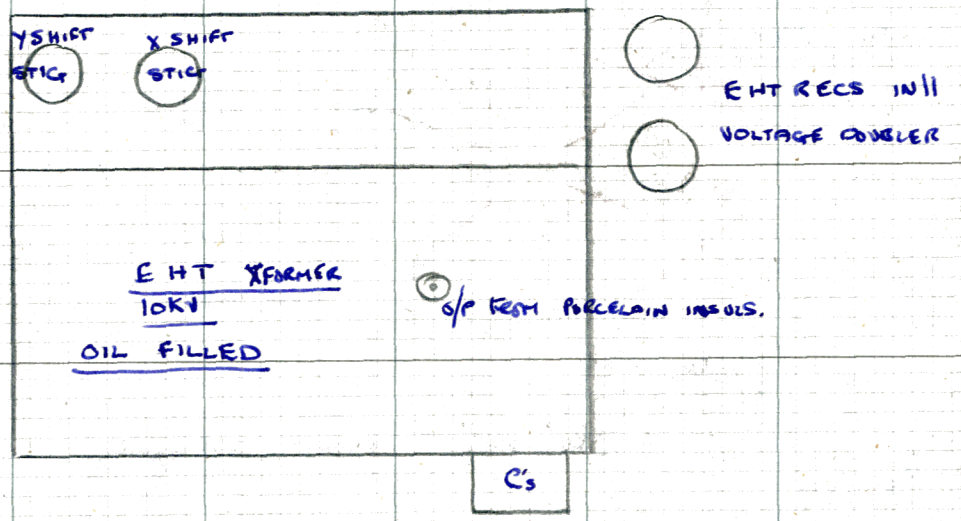




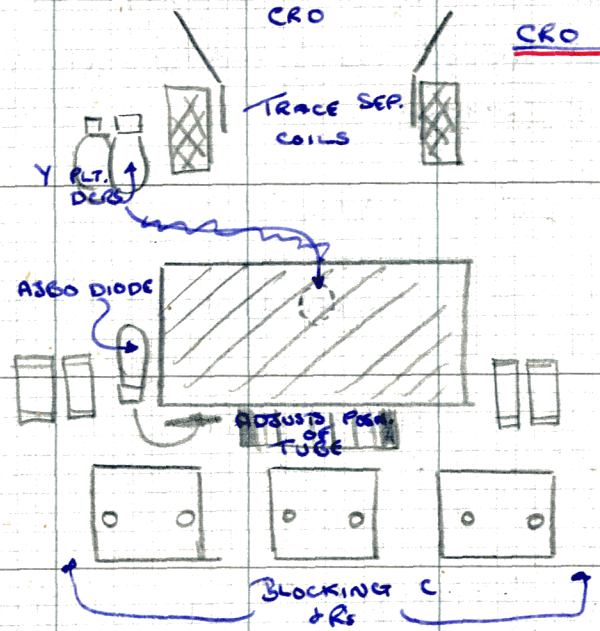
E HT Power Unit

LAYOUT:

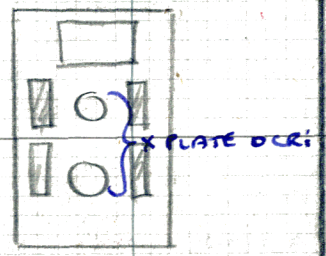
THE CONTROL ADJUSTED WHEN NEW TUBE REPLACED



CRO PANEL LAYOUT

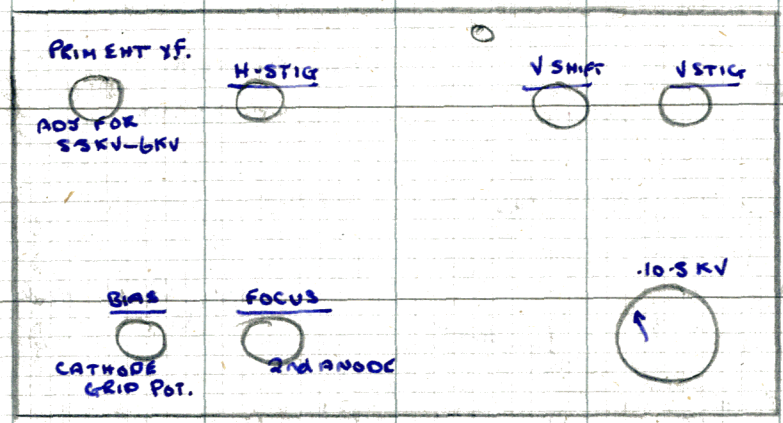


CU2 PANEL

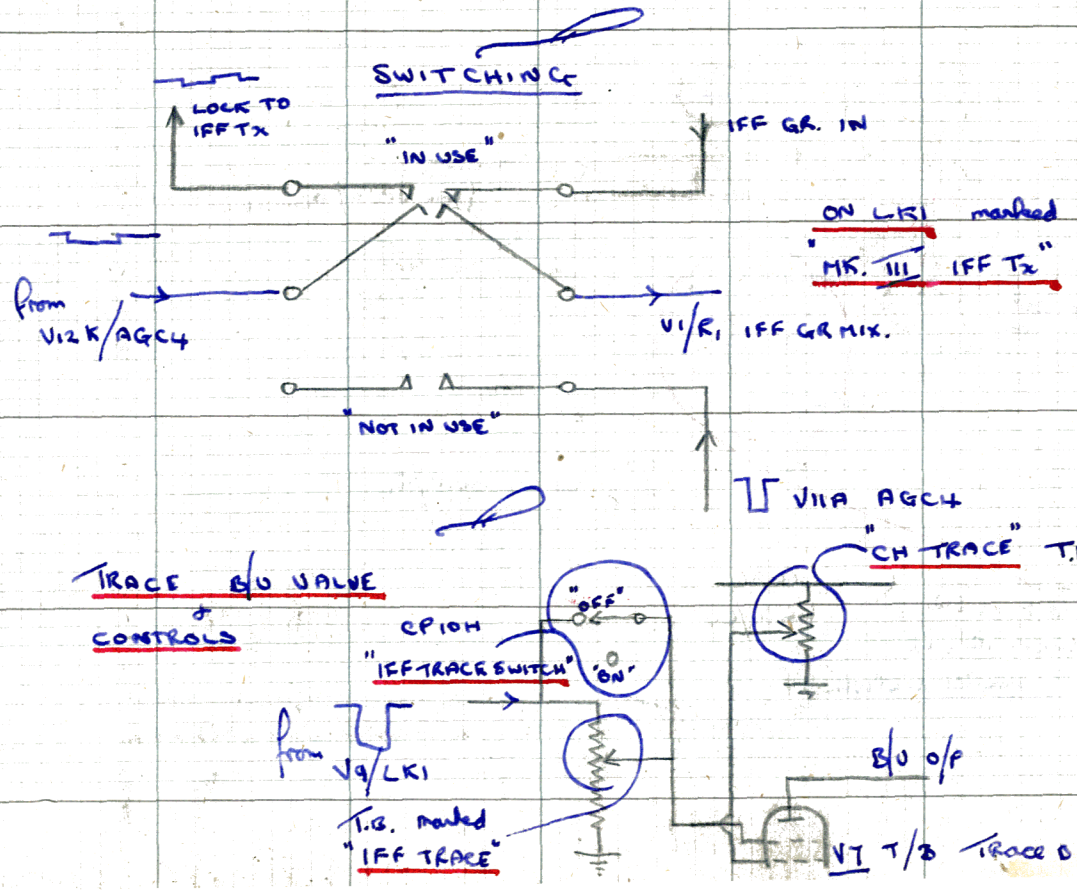


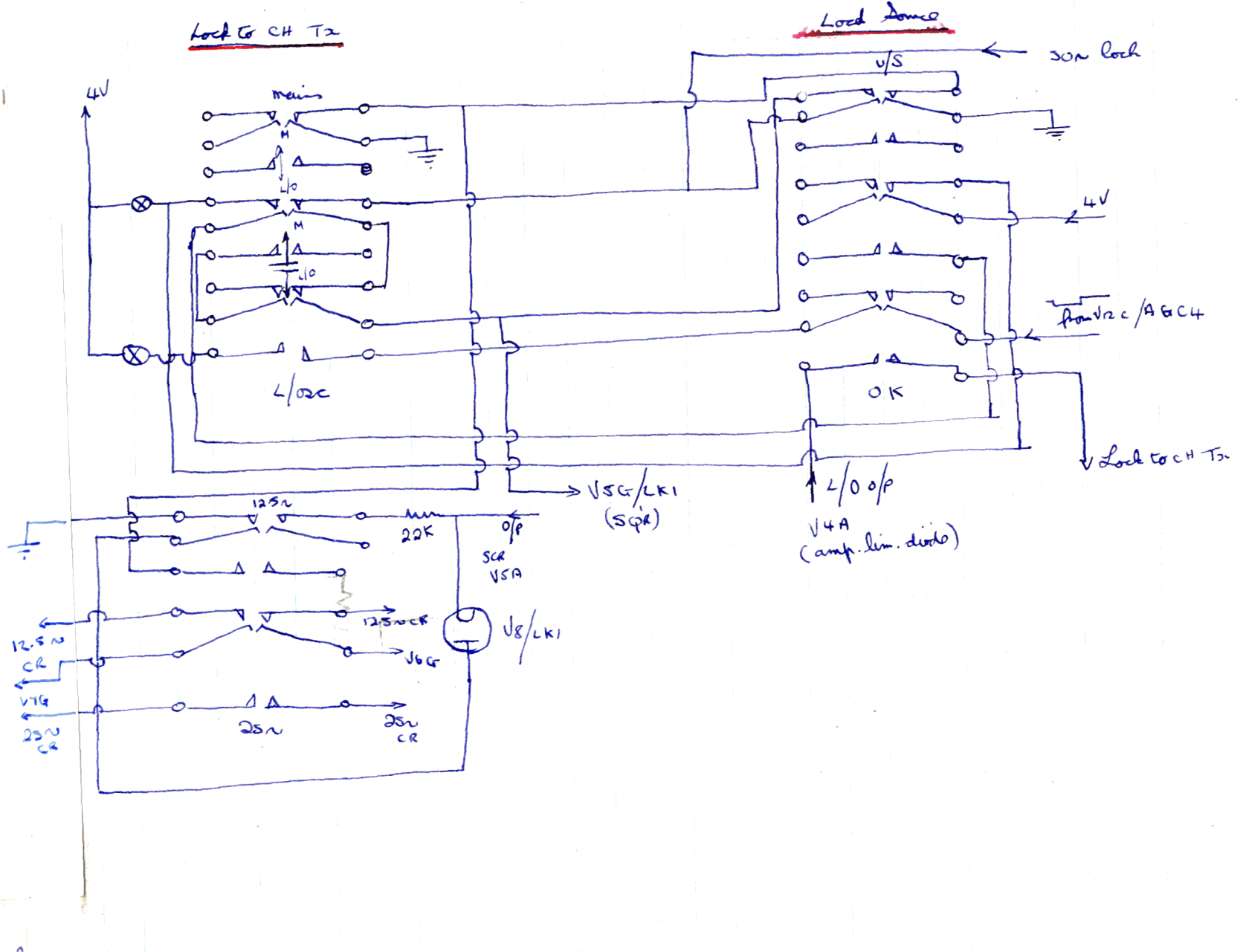
E.H.T. Power Unit

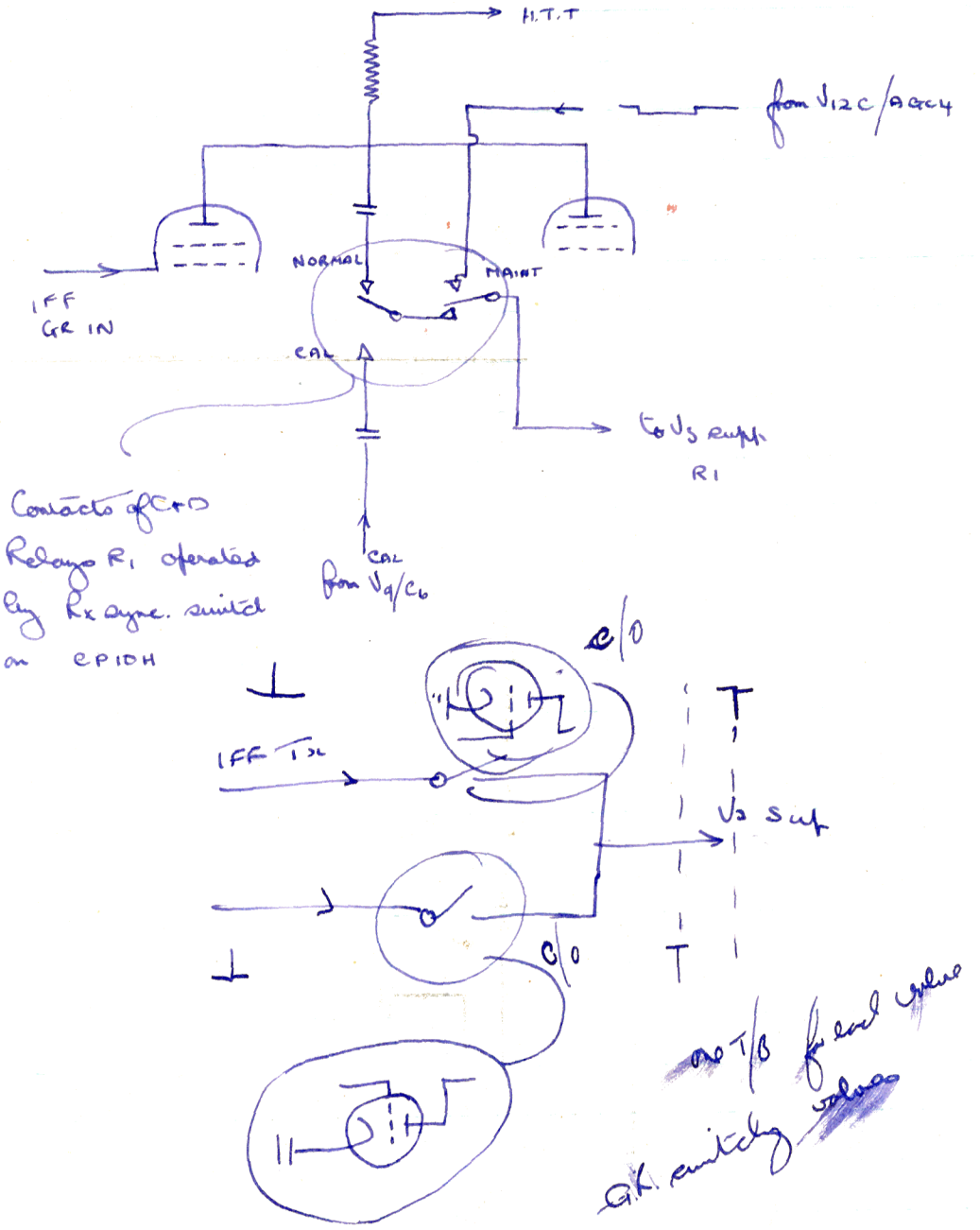
FRONT PANEL:



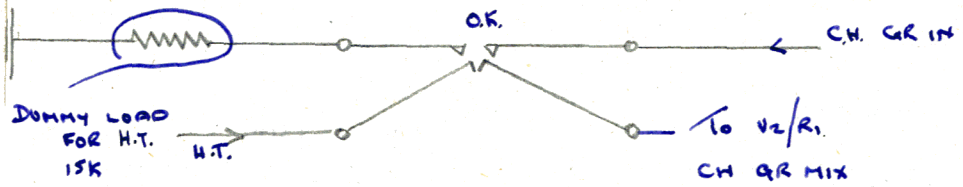
SWITCHING

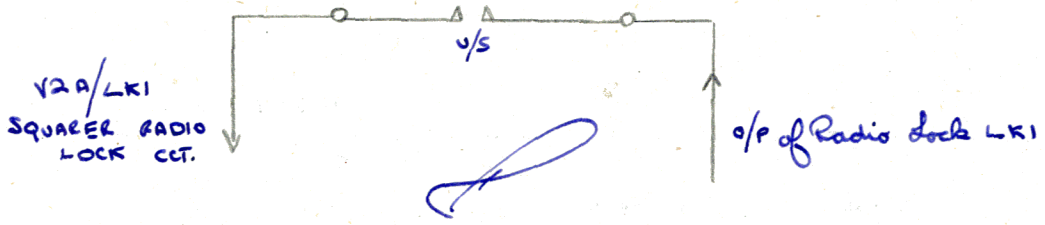



Lock to CH Tx
Load Sense
4V
main
M
L/O
M
L/O
L/O2C
V/S
SON lock
4V
from V12C/AGCH
OK
Lock to CH Tx
V5G/LK1
(SQR)
L/O o/p
V4A
(amp. lim. diode)
125Ω
22K
o/p
SCR
V5A
12.5Ω
CR
V7G
25Ω
CR
125Ω CR
V6G
V8/LK1
25Ω
25Ω
CR

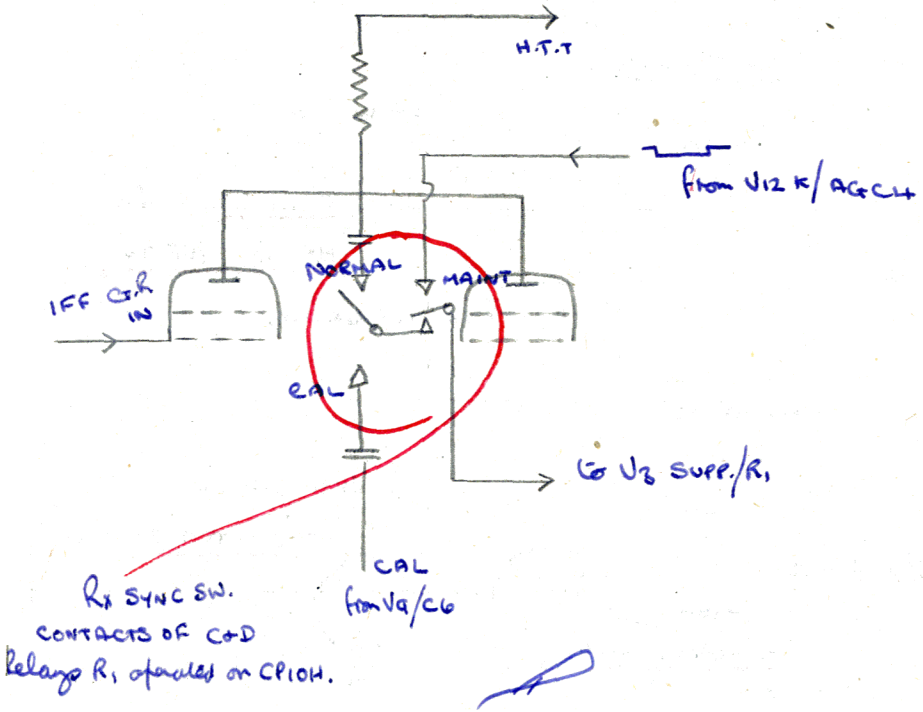

H.T.T
from V12C/AGC4
NORMAL
MAINT
IFF
GR IN
CAL
to V3 supply
R1
Contacts of C+D
Relays R1 operated
by Rx sync. switch
on EP10H
CAL
from V9/C6
C/O
IFF Tx
V3 supply
T
T
C/O
no T/B for end value
OK switching value

"Lock from CH Tx"



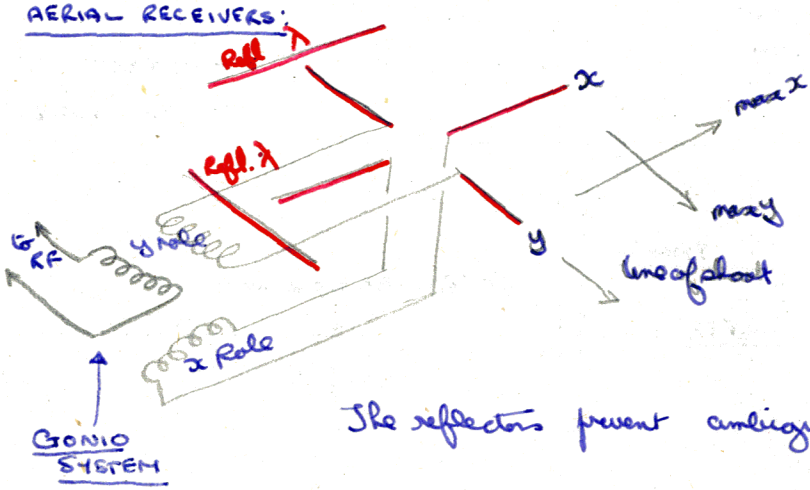


"Receiver Sync. Switch"



MAIN RECEIVER UNIT

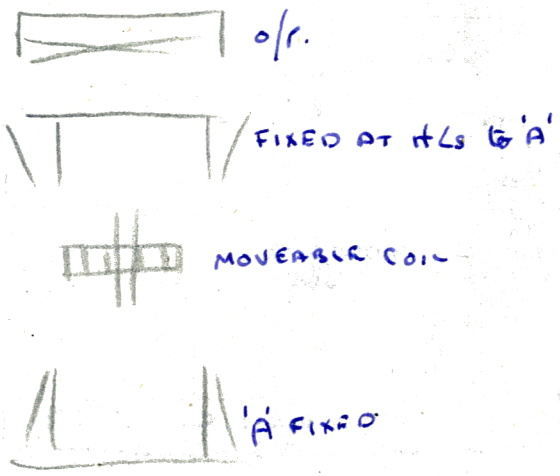
AERIAL RECEIVERS:



The reflectors prevent ambiguity

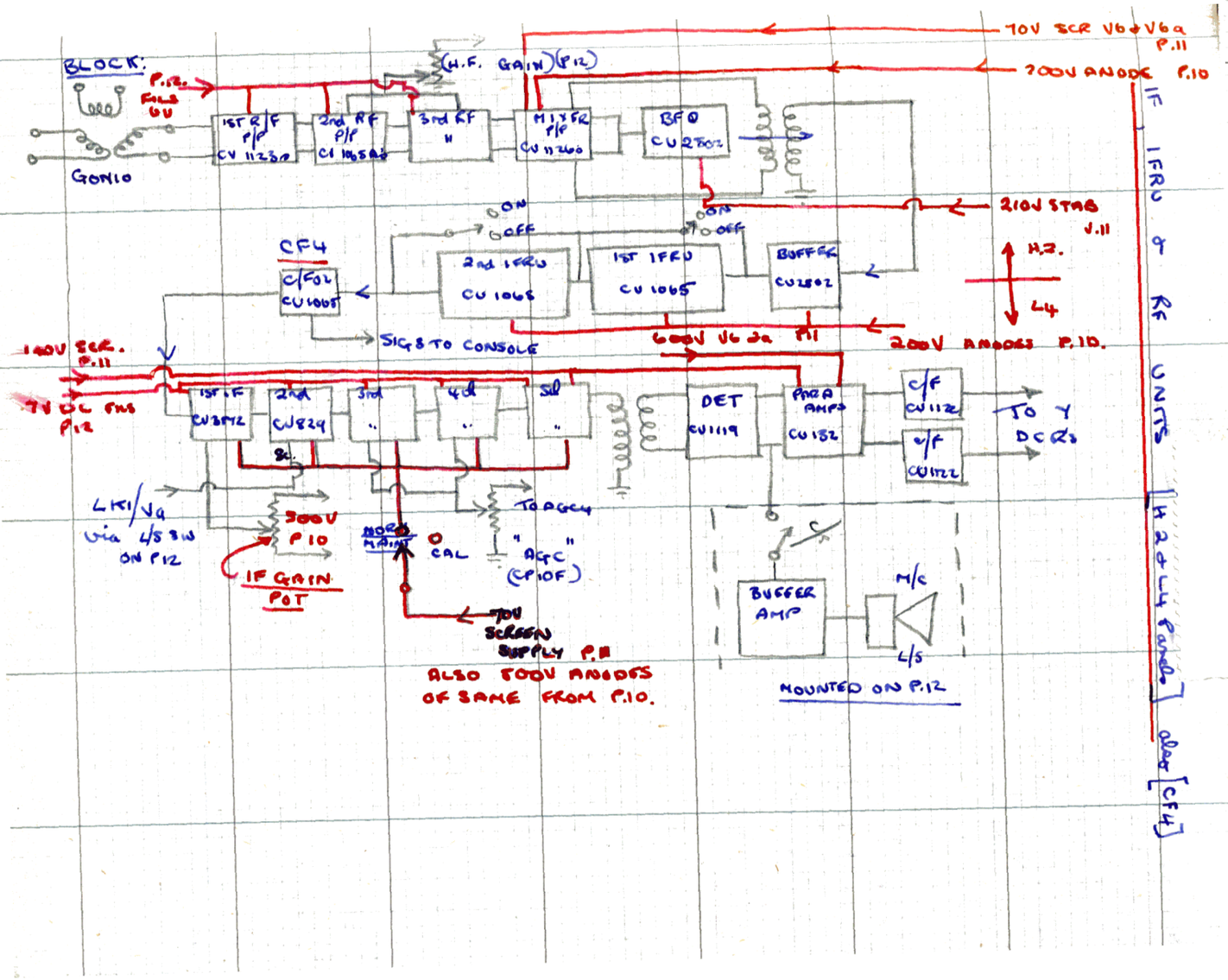
Gap filling methods are used i.e. arrays, similar to above 'A' system at 215', at 95' ['B' system] and 45' [C system]

GONIO LAYOUT



ACTION:

Moveable coil is rotated



RECEIVER CHAIN:

SUCCINCT DETAILS:

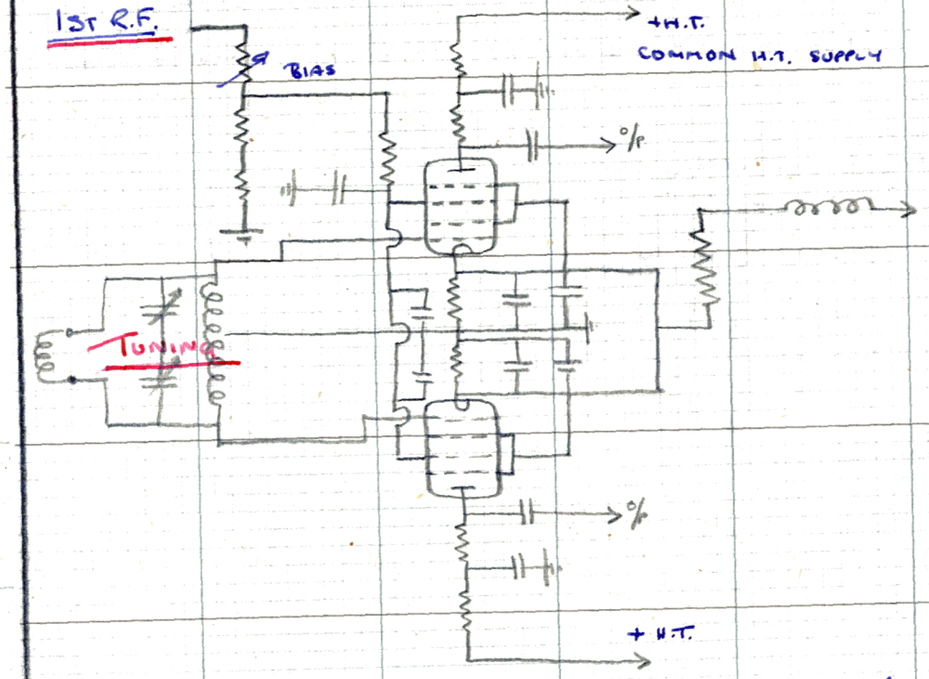
R.F. STAGES: RANGE 20-60 Mc/s in 4 bands
- i) 20-30 Mc/s
- ii) 26-38
- iii) 32-50
- iv) 40-60

Bandwidth 500 Kc/s

IF Rejection Units minimum rejection width; two bands of 8 Kc/s

IF Amps. Frequency 2 Mc/s, 3 bandwidths of:—
- i) 50 Kc/s (narrow)
- ii) 200 Kc/s (medium)
- iii) 500 Kc/s (wide)

1ST R.F.

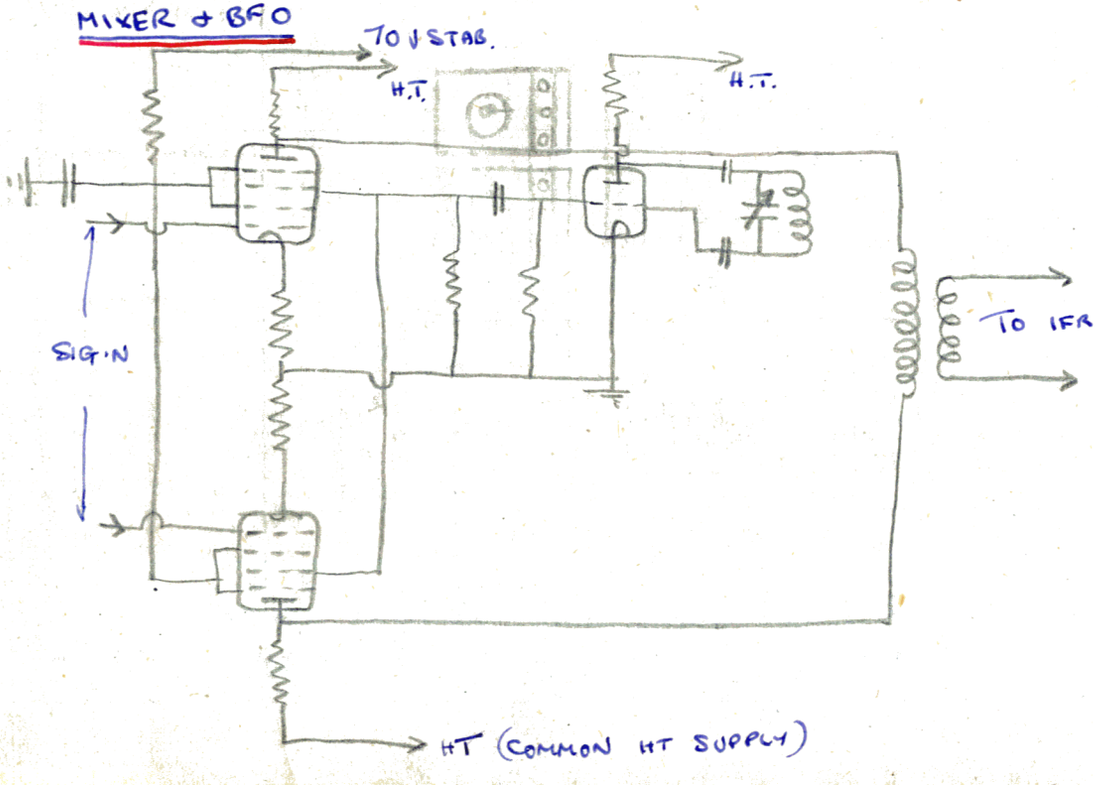


R.F Stage: Push Pull amplification throughout for symetrical amplification and stability thus simplifying decoupling. Input stage provides balanced connections to grid search coil.

1st RF: Employs special H.F. Pentode having small slot raised. a grid maintained at cathode potential concentrate electrons passing through into beams directed to pass through apertures in the screen with a great consequent large reduction in screen current. Isolating the input circuit from the heat generated by the valves minimises the noise due to thermal agitation.

Large amplitude ground rays are prevented passing thro' the amp. by passing a stabilised D.C. through the cathode bias resistances The effect of this current is to swamp any variations in grid bias produced by varying Ia's. The 50 μF electrolytics, shunting the bias resistances, present a large pure resistance at H.F or to H.F. They are therefore bipassed by small mica condensers which are connected across them.

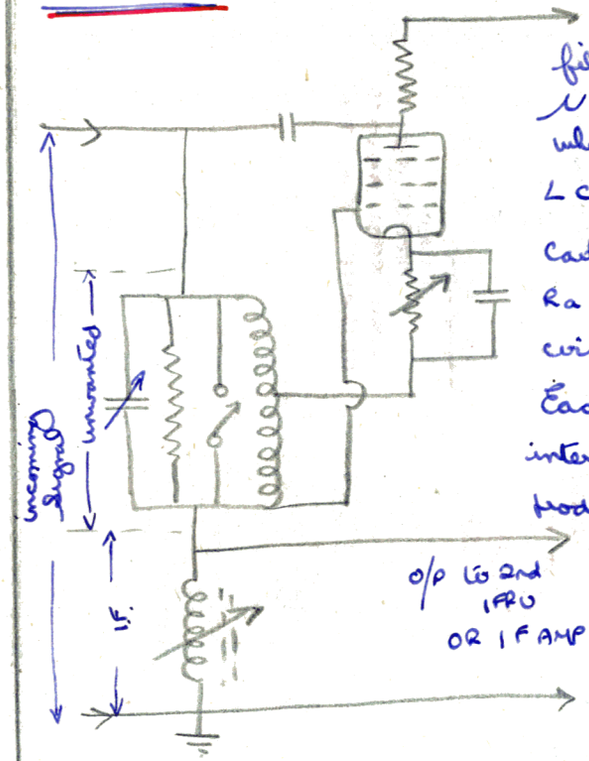
MIXER & BFO



ACTION: Push to sig i/p lowers the possibility of the D/F being pulled into step by the signal i/p. Mixer valves are operating 180° out of phase and should the local oscil. be pulled off frequency on one half cycle it will be cancelled out when the other valve conducts. Noise level is also reduced since the BFO is minimised or balanced out in the IF output circuit.

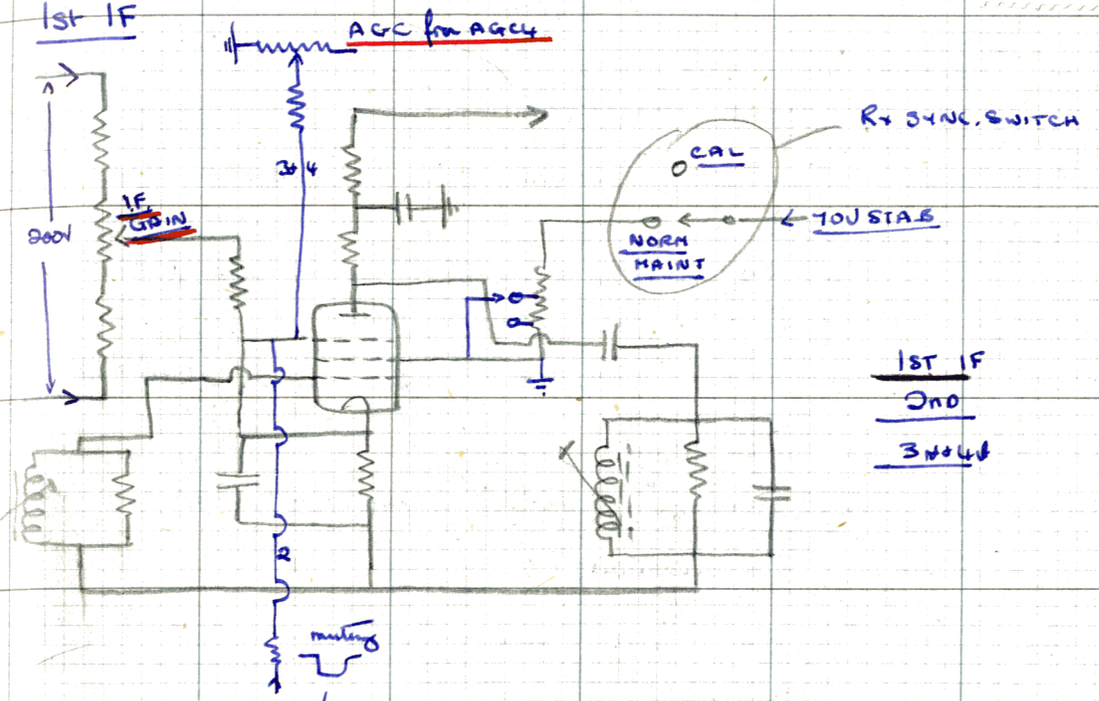
Oscillator: modified colpitts o/p taken across grid and cathode the coupling for oscillator maintainence being effected by stray capacity and interelectrode capacity of the valve

1ST IFRU



Incoming signal applied across filter comprising iron cored inductance L tuned to IF and an LC circuit which may be tuned to the unwanted signal LC circuit is in effect a Hartley osc. Cathode resistance which is in varying the Ra of the valve varies damping on the circuit with resultant control of selectivity Each filter may be tuned to separate interfering signals or both tuned to provide rejection of narrow band frequencies

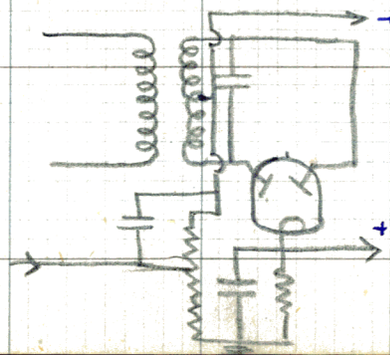
1st IF



IFS: Each bandwidth has separate tuned circuit; tuned "in line" on Narrow; "staggered tuned" with damping on medium, and wide "stagger tuned" and damping resistance on wide.
When wide bandwidth selected the coupling condensers are also changed. Normal working on medium bandwidth for best signal/noise ratio with least signal distortion.

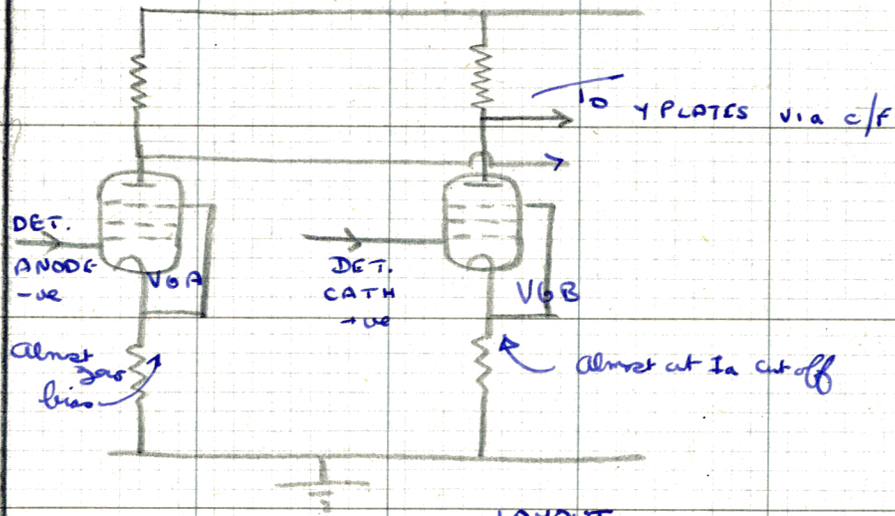
GAIN SWITCH: Shunts a fixed resistance in the 70 V screen supply to provide a rapid and fixed change in gain.

DETECTOR:

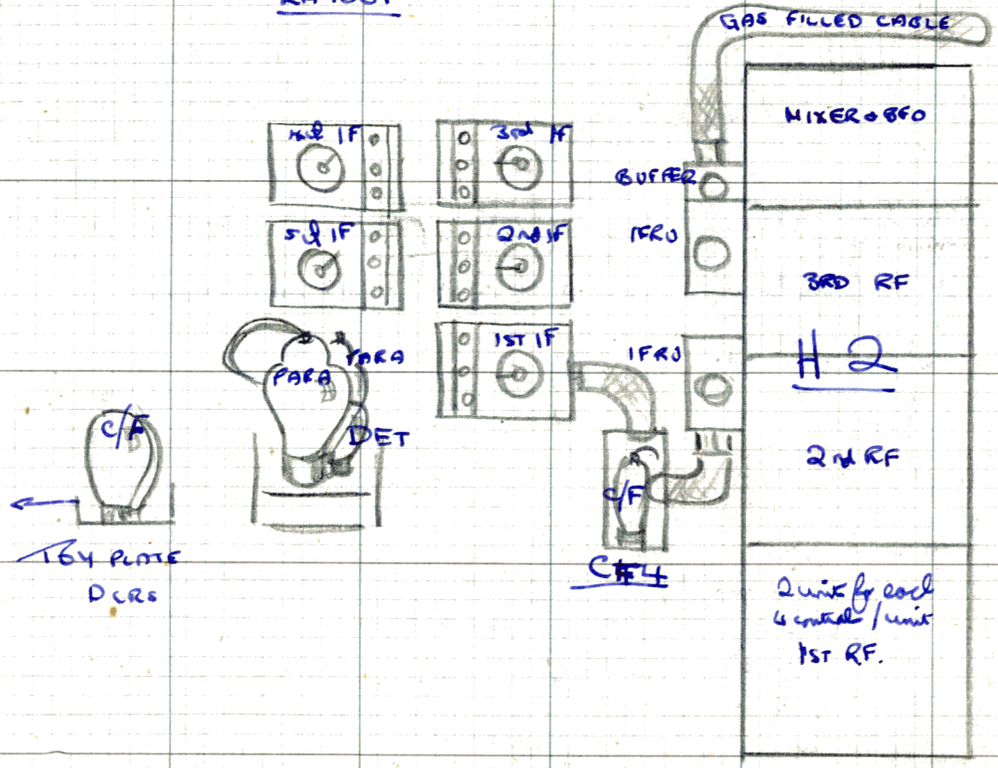


Full wave rectification preserves pulse shape and eliminates IF energy in the output.

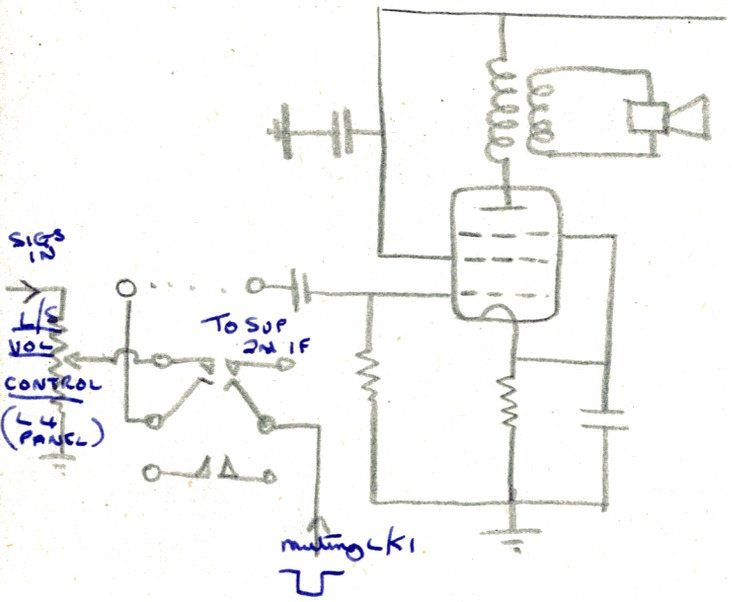
PARAPHASE AMPS:



LAYOUT



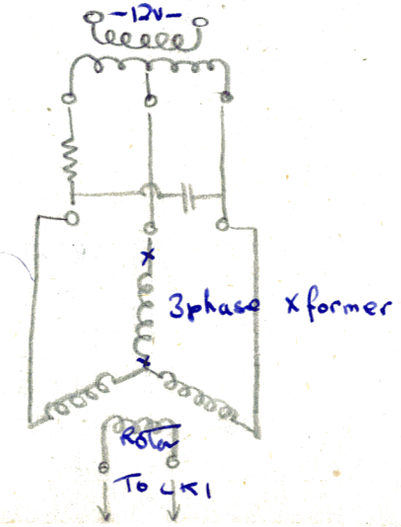
SPEAKER CIRCUIT



PURPOSE: To provide aural means of interference identification. When switched on muting pulse removed so that signals are not modulated by the 25 c/s muting pulse

PHASING CIRCUIT

Purpose: Allows phase of Tx relative to another in the CH system if it is interfering. It is a network such as follows:-



POWER SUPPLIES:

SEE BLOCK DIAGRAM.

WAVEFORMS: NONE NECESSARY.

SW CONTROLS: "H.F. GAIN": varies SCREEN potential of RF valves 2nd and 3rd.

"TUNING": grid and anode tuned circuits of all RF

(IFRU) "TUNING": unwanted sigs IFRU

(IFRU) "IFRU ON OFF": for either IFRU circuit on Rack, the switches shut out either IFRU circuit.

(IFRU) "R of CATHODE": varies damping of tuned circuit for unwanted sigs thus selectivity.

(REAR IFRU) [PRESET] "TUNING": IF of unwanted sigs see IFRU note

(CP10F) "AGC CONTROL": On suppressors of 1st IF 3rd & 4th IF varies input from AGC4. thus AGC on IF valve.

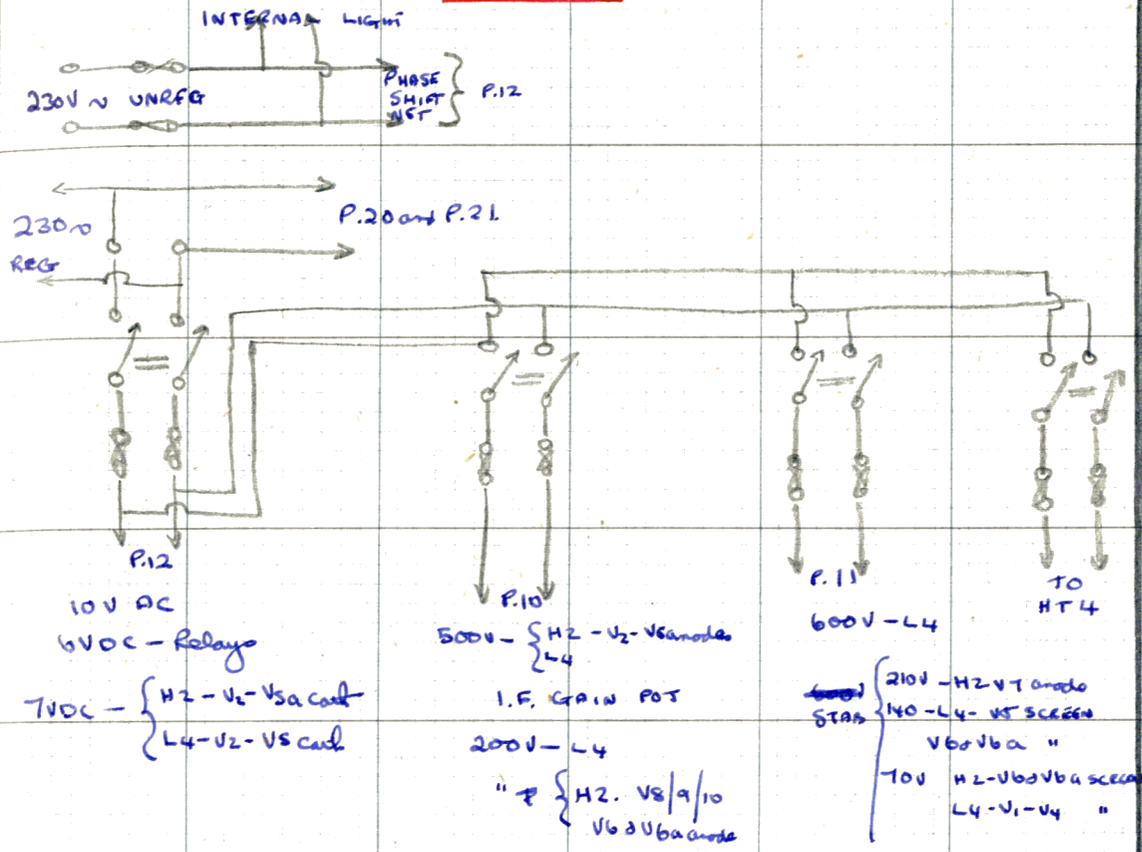
(CP10F) "IF GAIN": varies suppressor and cathode of 1st IF

(L4) "GAIN SWITCH": MENTIONED PREVIOUSLY

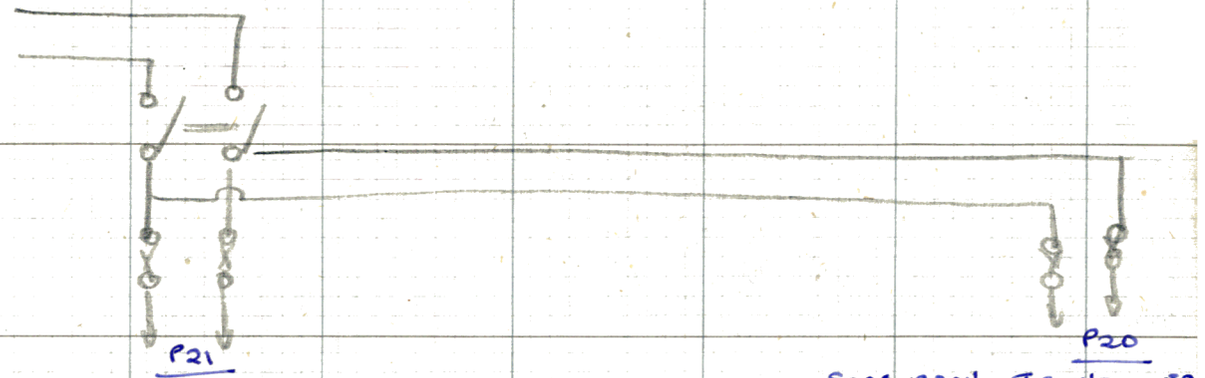
SCOPE PTS.: None.

POWER SUPPLIES

P10, 11 & 12



P20 & 2Φ



500V
- C6 – V6A
- LK1 – V5A
- CR01 – T13 / V6 V11A T/S COILS

250V
- CU25 – V1K, V5 SCR
- T13 – V7/8/9 A's and SCR.
- R1 – V1-2 A's & SCR. V14 A V3-13 SCR.
- LK1 – V2A, V5 SC. V6 – 7A, V11A

STAB. 250V – LK1 – V3A & SC.
140V – AGC4 – V12A
and all ~~heaters~~ RACK TYPE B3

STAB 1200V – T13 – V2, 4 & 5A

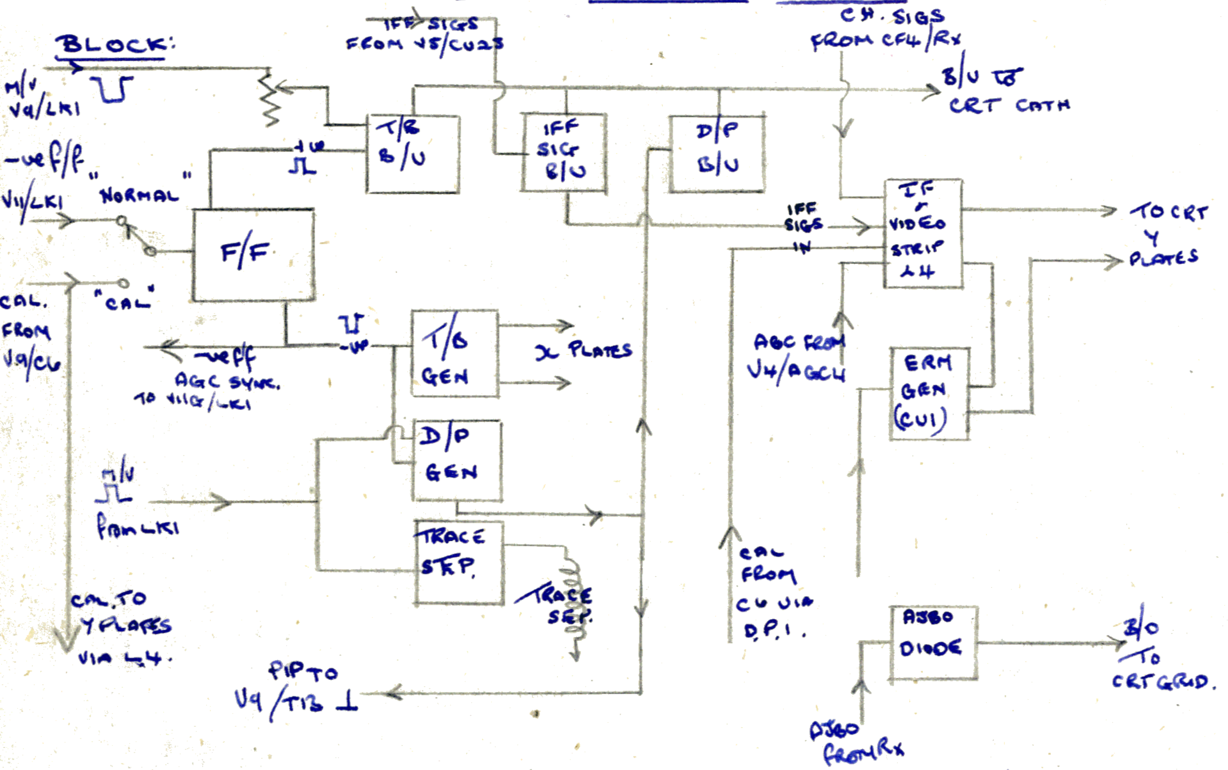
STAB 500V
- T13 – V3A
- R1 – V3 – 13A
- CU25 V1 – 15A

700V floating R1 – V7

24 VAC – CAC/ADJ 16 motor

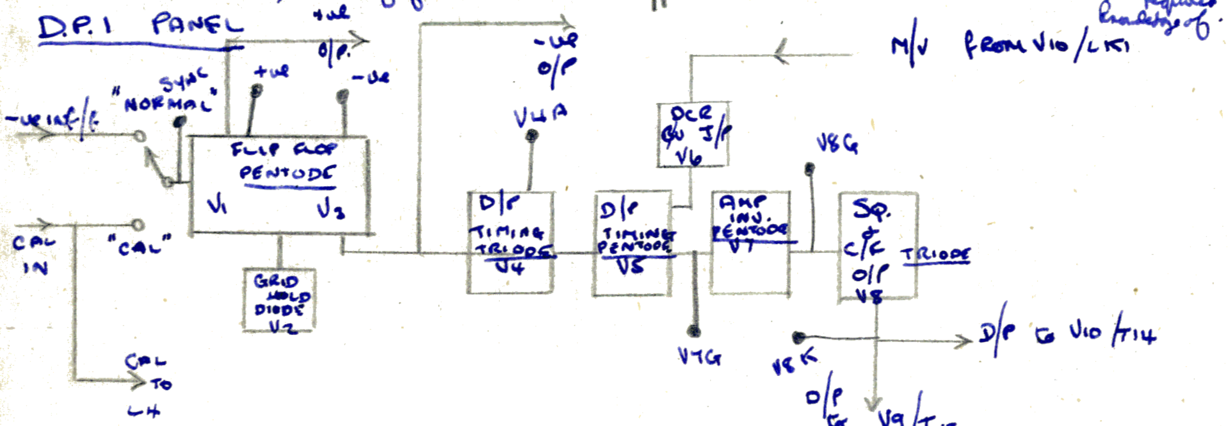
~~DIPOLE~~ CONSOLE TYPE 2/3

BLOCK:

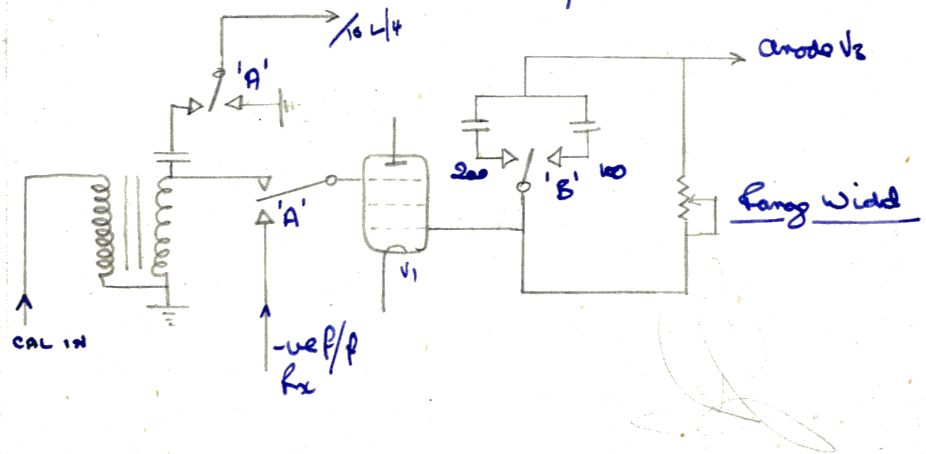


PURPOSE (i) a liason with CH receiver operator and plotters ie D/P indicates signal ~~ii) Tracking of lite~~ required knowledge of.

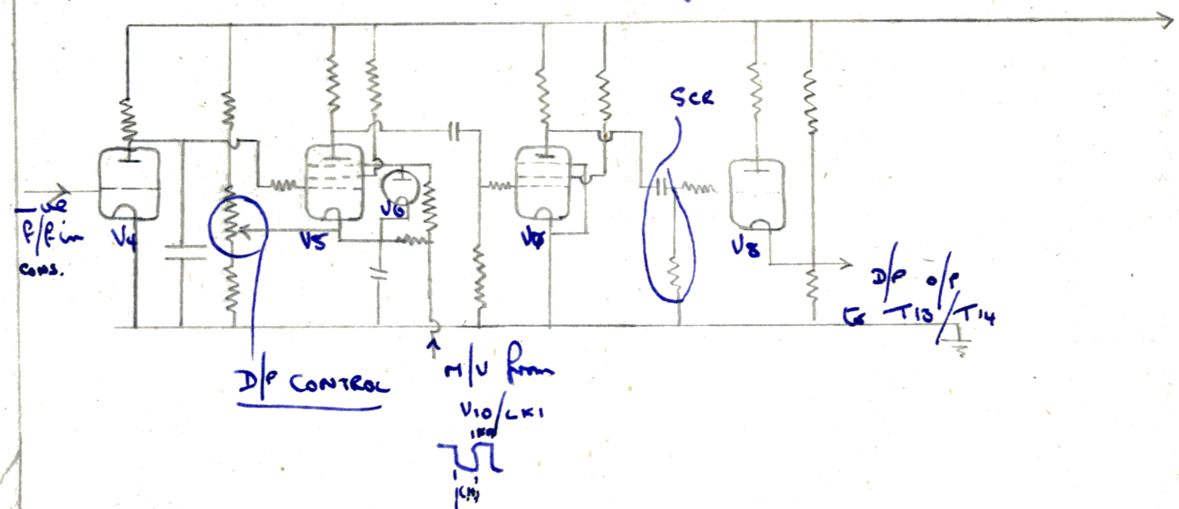
D.P.1 PANEL



V1 CONSOLE FLIP/FLOP



D/P circuit [simplified]



ACTION: Director Pulse gen.

V4: is normally conducting and V5 cut off by a voltage determined by the setting of the "D/P control". The -ve f/f pulse applied to V4 grid cuts the valve off producing a +ve going exponential at its anode due to the charging of the condenser C.

When the amplitude of that voltage is such that it cuts on V5, the leading edge of the anode voltage of V5 is retarded on that of the flip/flop waveform by an amount set by the negative bias on V5 grid. That bias being variable produces a waveform of varying width in the anode.

The anode waveform of V5 is amplified and phase inverted by V7 and applied to the output valve V8 via a short CR. V8 operates as 1) a squarer, being biased beyond cut off and the grid prevented from swinging +ve by the grid stopper.

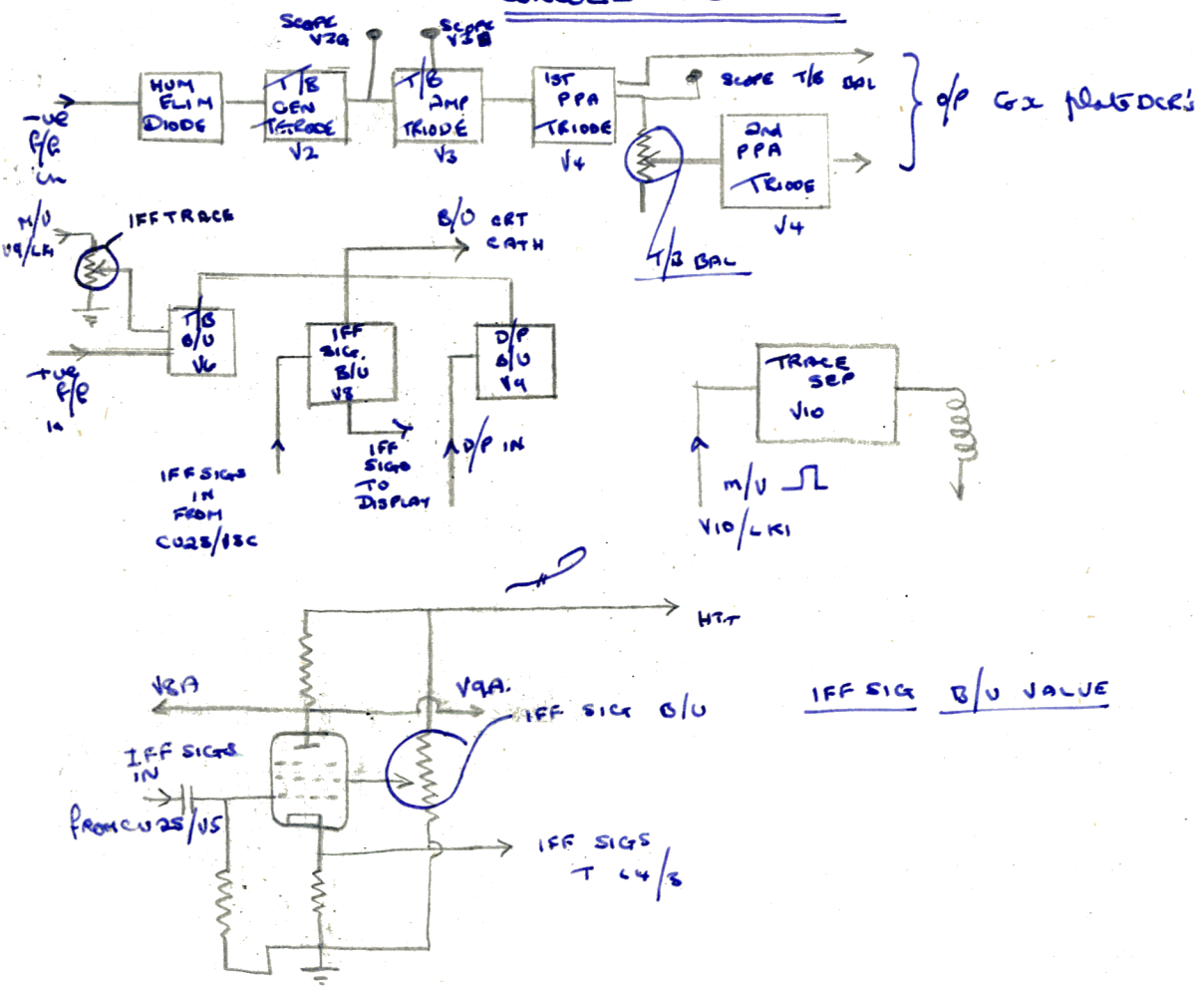
2) as a cathode follower feeding the O/P to T14 and T13 to trigger the O/P bright up circuit. The o/p waveform is approx 5 usec wide.

During CH T/B's V5 is cut off on its suppressor grid by the M/V output from V10/LK1. Which is fed via the DCR V6, as the M/V O/P is -ve going with respect to earth and the cath. of V5 having to be brought almost to cathode potential at least before V5 will conduct during the IFF time period.

WAVEFORMS:

C S SP P S L P

CONSOLE T/B PANEL



IFF SIG B/U VALUE