A.W.A VERTICAL CHASSIS MODEL 220

SYNC. & SWEEP CIRCUITS

H = HORIZONTAL — O = OPEN

V = VERTICAL — L = LEAKAGE — S/C = SHORT CIRCUIT

EFFECT		POSSIBLE CAUSE	
No H & V Sync.	6CG7	C306 "O" or "L"	
		C308 "O"	
No V Sync.	.033. 400V.	C308 "L"	8200
	.027 400V.	C311 "s/c"	
V Lock Hardover		C312 10M ohm L	
V Foldover Top & Bottom		C312 over 10M ohm L	
V Strectch & Jitter		C314 L	
		R327 High	
V Shrink with Bottom Cramp		C313 L	
Bottom Cramp with top stretch		C316 L .022	
		R329, 330, 331 High	
		C317A O	
Bottom Stretch, Top Cramp, & Jitter		C315 L	
Loss Of Height with severe top cramp		R338 High	
Slight Bottom Cramp		C317B O	
V Retrace Visible		R337 C319 C321 O	
V Overscan, Reduced Width		C321 L 30K ohm	
Excessive Brightness			
Partial Loss of H Sync with bend in Pix.		H/C L in V401A	Hor. control.
Loss of H Sync	82 PF	C309 O or L	

A.W.A. VERTICAL CHASSIS MODEL 220

SYNC. & SWEEP CIRCUITS(CONTINUED)

EFFECT		POSSIBLE CAUSE	
Rapid sideways movement with instability	.022 200V	C402	) 0
Ditto With bend at top	.47 100V,	C404	0
Slightly Wavy verticals	.01 ST ~~270PF~~	C406	S/C
H Osc. Slow	270PF ~~.01 600V~~ MICA	C405	L
	220K 120K	R404, R406	High
Syncroguide Inoperative	MICA 82 PF	C403	L
	MICA 82 PF	C309	L
Narrow scan, Bright Vertical Bars Foldover		C413	0
Narrow Scan, Vert. Stretch Reduced E.H.T		C413	L
Narrow Scan Reduced EHT		C414	L
Ditto With Slight horizontal Wave Lengths		C414	0
Lack Of Width		C425	S/C
		C409	L
Ditto		C410	L or 0
Lack of Width with Horizontal Osc. Slow		C411	0
No Brightness		C409	0
		C424	0
Ringing		R417	High or Open
Ringing with Reduction of Width		C415	L or 0
A.G.C Control Abnormal		C417	Faulty
		C418	Faulty

A.W.A VERTICAL CHASSIS MODEL 220

A.G.C.VIDEO & I.F

EFFECT	POSSIBLE CAUSE
Overload (Blank Raster Possible Weak sound)	R. 311 Open
Snow on Picture	C. 301 Short
	R. 302 R. 302 Open
Excessive Brightness no Control	C.322 Short
Excessive Brightness insufficient control	C. 224 Short
Contrast Control varies Brightness	C. 227 leaking
Excessive Contrast	C. 226 Short
Insufficient range of contrast control	C. 226 open.
Excessive contrast, pulling and no show on blank channels	C. 221 Short
Very weak picture hardly visible	C. 227 Open
Picture weak but visible	C. 225 Open
No Greys in picture	C.225 leaking slightly
Negative Picture	C. 225 leaking badly
	L. 207 Open
Poor Resolution (H.F. response)	L. 206 L.207 Short
Blank Raster, buzz on sound	L. 206 Open
Pulling, poor horizontal sync.	C. 218, C. 219 Faulty
No Picture No Sound	C. 217 Open
A.G.C. Control Abnormal	C. 417 Faulty
	C. 418 Faulty

"SYNC. & SWEEP."

EFFECT	CAUSE
Lack of H & V Sync.	C-306 open or leak. C-308 open.
Lack of V sync. only	C-308 leak. C-311 short.
V. lock with control full anti-clockwise.	C-312 10 Megohm leak.
V. foldover (super-imposition top and bottom half).	C-312 leak more than 10 Megohm.
V. stretch and jitter.	C-314 leak. R-327 high.
V. shrink with bottom cramp.	C-313 leak.
Bottom cramp with top stretch.	C-316 leak. R-329, 330, 331 high. C-317A open.
Bottom stretch, top cramp and jitter.	C-315 leak.
Loss of height, with severe top cramp.	R-338 high.
Slight bottom cramp.	C-317B open.
Vertical retrace visible.	R-337, C-318, C-321 open.
V. overscan, reduced width, excessive brightness.	C-321 leak 30,000 ohms.
Loss of H. sync.	C-308 open or leak. C-4 02, C-404 short.
Partial H sync. with bend in picture.	Heater-cathode leak V-401A.
Rapid sideways movement with instability.	C-402 open.
Ditto with bend at the top.	C-404 open.
Slightly wavy verticals.	C-406 short.

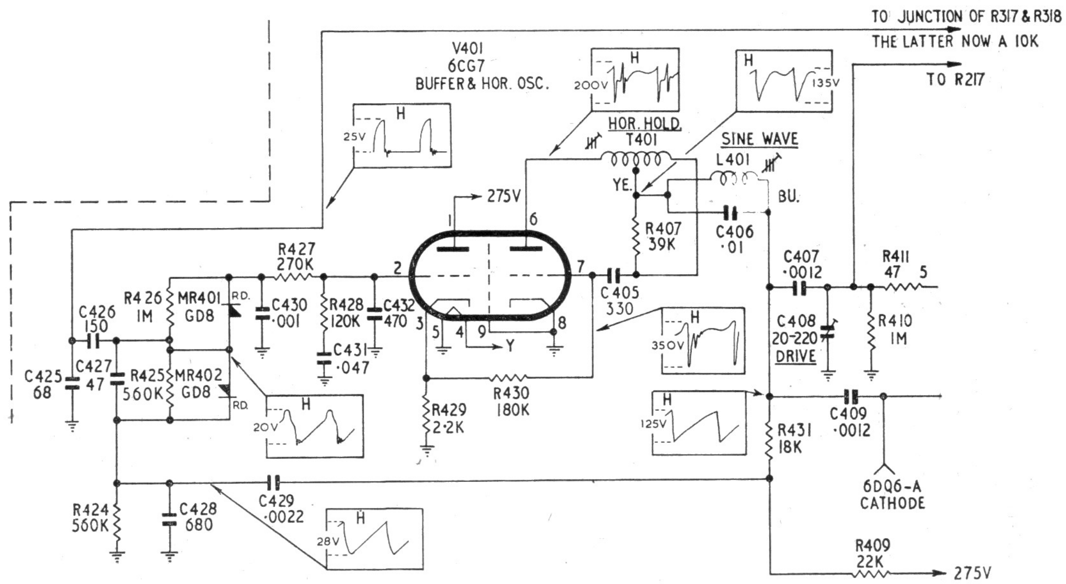
H. osc. slow.	C-405 leak. R-404, R-406 high.
Synchroguide inoperative.	C-403 leak. C-308 leak.
Narrow scan, bright vertical bars, foldover.	C-413 open.
Narrow scan, vertical stretch, reduced EHT.	C-413 leak.
Narrow scan, reduced EHT.	C-414 lak.
Narrow scan, reduced EHT, slight horizontal wave LHS	C-414 open.
Lack of width.	C-425 short. C-409 leak.
Lack of width.	C-410 leak or open.
Lack of width with H. Sec. slow.	C-411 open.
No brightness.	C-409 open. C-424 open.
Ringing.	E-417 high or open.
Ringing with reduction of width.	C-415 leak or open.
ACC Control abnormal.	C-417 faulty. C-418 faulty.

= = = = = = = = = = = = = =

A.W.A. RADIOLA TELEVISION ADDENDUM SHEET

PHASE DISCRIMINATOR CIRCUIT MODIFICATION

This circuit change is incorporated in Models 220, 221, 223 and 224, which have X stamped on their chassis.



R318	10K ohms.	±10%	1 watt.
R409	22K ohms.	±10%	1 watt.
R424	560 ohms.	±10%	½ watt.
R425	560K ohms.	±10%	½ watt.
R426	1 meg ohms.	±10%	½ watt.
R427	270K ohms.	±10%	½ watt.
R428	120K ohms.	±10%	½ watt.
R429	2.2K ohms.	±10%	½ watt.
R430	180K ohms.	±10%	1 watt.
R431	18K ohms.	±10%	1 watt.

C405	330 pf.	±5%	1000VW Silvered mica.
C425	68 pf.	±10%	500VW Silvered mica.
C426	150 pf.	±10%	500VW Silvered mica.
C427	47 pf.	±10%	500VW Silvered mica.
C428	680 pf.	±10%	500VW Silvered mica.
C429	0.0022 uf.	±10%	600VW paper.
C430	0.001 uf.	±10%	600VW paper.
C431	0.047 uf.	±10%	200VW paper.
C432	470 pf.	±10%	500VW Silvered mica.
MR401	Germanium Diode.		GD8.
MR402	Germanium Diode.		GD8.

ADJUSTMENT PROCEDURE:

This horizontal oscillator may be adjusted by either of the following two methods:—

Method 1:

(a) Short circuit the "Sine Wave" stabilising coil L401.

(b) Connect a high impedance D.C. voltmeter from pin 2 of V401 to earth and adjust the horizontal hold control for a reading of 0 volts on the meter.

(c) Remove the short circuit from the "Sine Wave" stabilising coil and adjust the iron core of this coil until the meter indicates 0 volts when the picture is synchronised.

Method 2:

(a) Short circuit the "Sine Wave" stabilising coil L401.

(b) Short circuit pin 2 of V401 to earth.

(c) Adjust the horizontal hold control until the sides of the picture are vertical.

(d) Remove the short circuit from the "Sine Wave" stabilising coil and adjust the iron core of this coil until the sides of the picture are again vertical.

(e) Remove the short circuit from pin 2 of V401.

When the adjustment is correct, the horizontal hold should perform as follows:—

CHECK OF HORIZONTAL OSCILLATOR ADJUSTMENTS.

Turn the horizontal hold control to the extreme clockwise position. The picture should be out of synchronisation with a minimum of 10 bars slanting downwards towards the left. Turn the control slowly anti-clockwise. The number of diagonal black bars will gradually reduce, and when only 1½ to 3 bars remain, the picture will synchronise with further slight anti-clockwise rotation of the control. The picture should remain synchronised for at least 4 full turns of additional anti-clockwise rotation of the control. Continue to turn the control in this direction until synchronisation is lost. Turning the control beyond this point should produce a minimum of 6 bars before end of rotation or interrupted oscillation (motor-boating) occurs.

ADDENDUM SHEET

ALIGNMENT PROCEDURE FOR 220Z, 221Z

NOTE: When two positions of the core appear to give the correct adjustment, the following apply:—

* coil tuned with core close to chassis.

† coil tuned with core close to can top, i.e., remote from chassis.

SOUND I.F. ALIGNMENT

Connect the output of the television calibrator to pin 7 of V204 (video amplifier).

Set the calibrator frequency at 5.5 Mc/s.

Set the contrast control maximum clockwise.

Short circuit pin 1 of V203 (3rd video I.F.) to ground.

Connect the Voltohmyst D.C. probe to pin 1 of V102 (ratio detector) and set the range switch to +5 volts D.C.

Adjust the following transformers for peak output, varying the input to maintain a reading of about +3 volts.

T101 (ratio detector transformer) secondary (bottom core)*.

T101 primary (top core)†.

L101 (sound take off)*.

L205 (sound trap)*

Repeat this sequence once.

Transfer the Voltohmyst probe to the junction of R104 and C108.

Re-adjust T101 secondary (bottom core)* for zero reading on the Voltohmyst.

Set the calibrator modulation switch to 600 c.p.s.

Connect the C.R.O. to the kinescope grid (test point "video out") through a crystal probe. (Voltohmyst probe 2R56020 is suitable.)

Re-adjust L205 (sound trap)* for minimum 600 c.p.s. on the C.R.O.

VIDEO I.F. ALIGNMENT

Turn R301 and R218 to their extreme clockwise position when viewed from the wiring side.

Connect a source of —3V bias to the video I.F. at the junction of R201 and C301 (test point "I.F. A.G.C.").

Connect the Voltohymst D.C. probe to pin 7 of V204 (video amplifier) and set the range switch at —5V D.C.

Set the channel selector on channel 6 and the fine tuning control at its mechanical centre. Check that the oscillator frequency is 211.25 Mc/s ±0.5 Mc/s.

Connect the calibrator output to TP2 on the tuner through 1,000 pf capacitor using short leads.

Set the calibrator to the frequencies shown and adjust the following transformers for a peak output, reducing the input to maintain a reading of about —3 volts.

31.6 Mc/s	T201*
34.0 Mc/s	T203*
35.25 Mc/s	T202 (bottom core)*

Set the calibrator to the frequencies shown and adjust the following traps for a minimum output increasing the input to maintain an output of —1V D.C.

37.5 Mc/s	L201*
30.0 Mc/s	T202 (top core)†

Remove Voltohmyst and calibrator.

Connect a source of —2.5 volts bias to the tuner A.G.C. terminal. The I.F. bias remains at —3 volts.

Connect the sweep generator to the aerial input terminals on the tuner. Set the sweep to channel 6. Connect the C.R.O. vertical input to TP1 on the tuner through a shielded lead.

Check that the R.F. response viewed on the C.R.O. conforms with that shown in Fig. 11.

Connect the crystal detector probe (Fig. 3) to pin 5 of V201 (1st video I.F.) and the bypass lead to pin 5 of V202 (2nd video I.F.).

Set the sweep generator output to give 0.3V p/p on the C.R.O.

Adjust T2 (tuner)† and L202* to give 36 Mc/s at 80% with symmetrical peaks.

Adjust trimmer C204 and L202 to give 31.75 Mc/s at 80%.

T2 mainly affects 36 Mc/s position.

L202 mainly affects tilt.

C204 mainly affects bandwidth.

Required response is shown in Fig. 7.

Remove the crystal detector probe and connect the C.R.O. to pin 7 of V204 (video amplifier) using the network shown in Fig. 4.

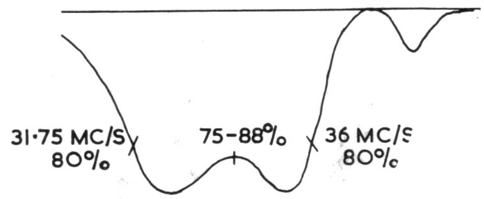


FIG. 7

View the overall response with 3V p/p output and adjust, if necessary, the following coils to give the required response of

36 Mc/s at 50%	T202 (bottom core)*
30.5 Mc/s at 5%	T201*
No tilt	T203*

The required response is shown in Fig 8.

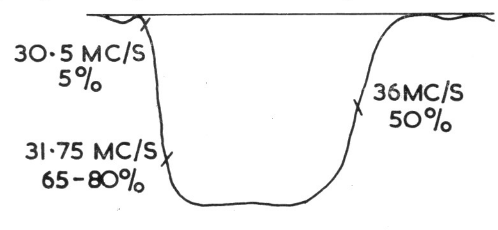


FIG.8

Re-adjust T202* to give 36 Mc/s at 30%. This should require the bottom core to be turned through approximately half a turn clockwise (as viewed from the wiring side of chassis.) Remove any tilt by adjusting T203.

The final response is shown in Fig. 9.

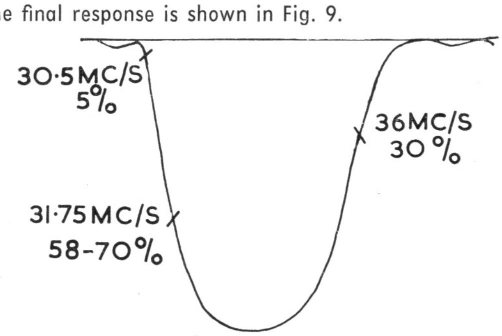
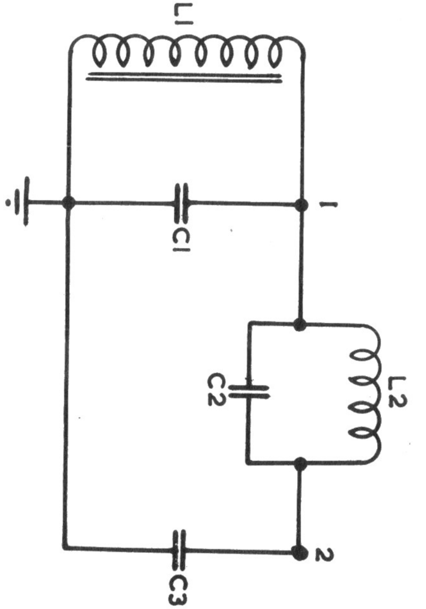
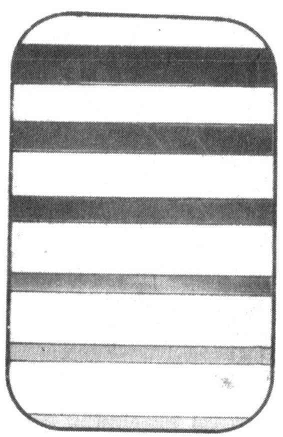


FIG.9



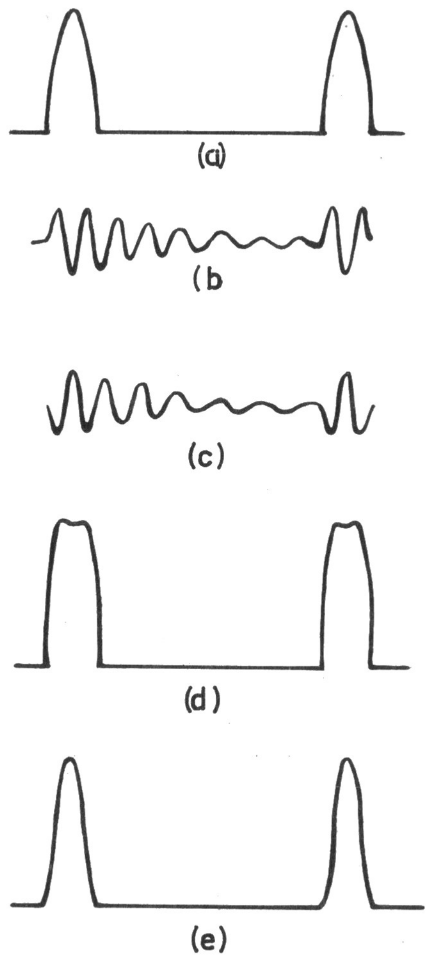
EQUIVALENT CIRCUIT OF HORIZONTAL OUTPUT STAGE DURING RETRACE

FIG.17.9.



TERTIARY RINGING.

FIG.17.7



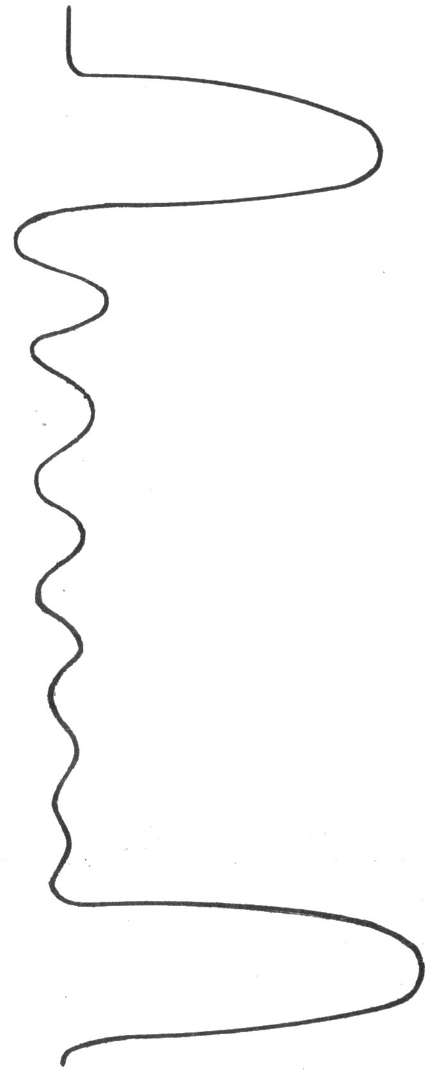
(a) FUNDAMENTAL RETRACE PULSE

(b) & (c) RINGING VOLTAGE AT POINTS 1 & 2 OF FIG.17.9.

(d) RESULTANT VOLTAGE OF (a) + (b)

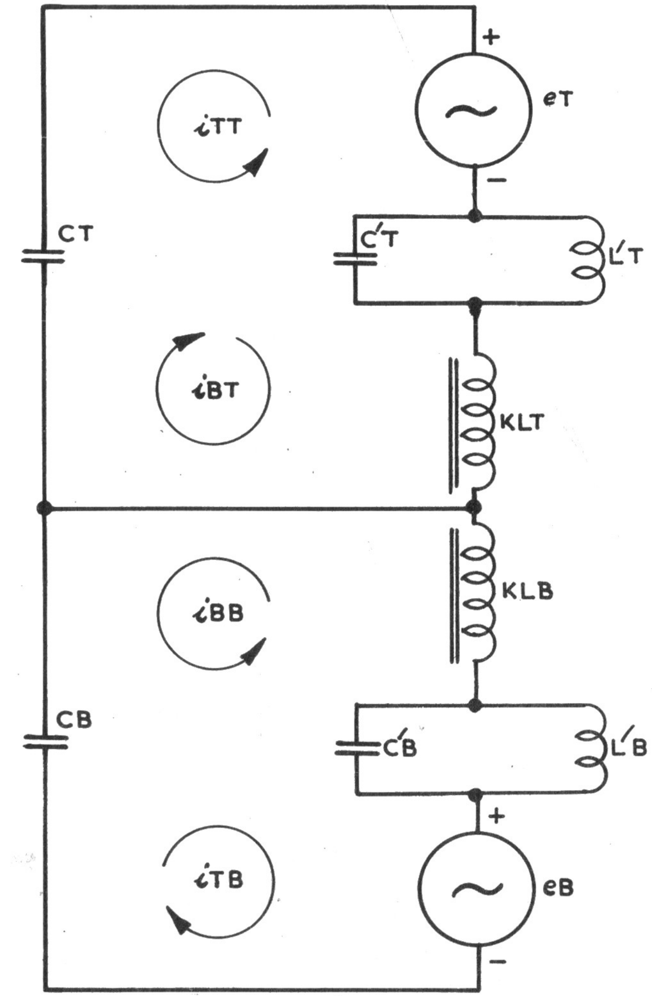
(e) RESULTANT VOLTAGE OF (a) + (c)

FIG.17.10.



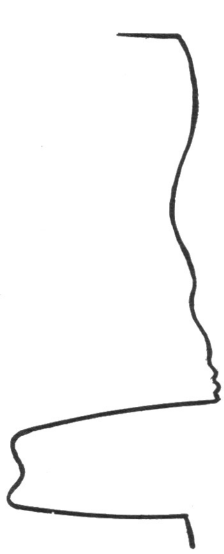
VOLTAGE WAVEFORM SHOWING RETRACE PULSE AND TERTIARY RINGING.

FIG.17.8.



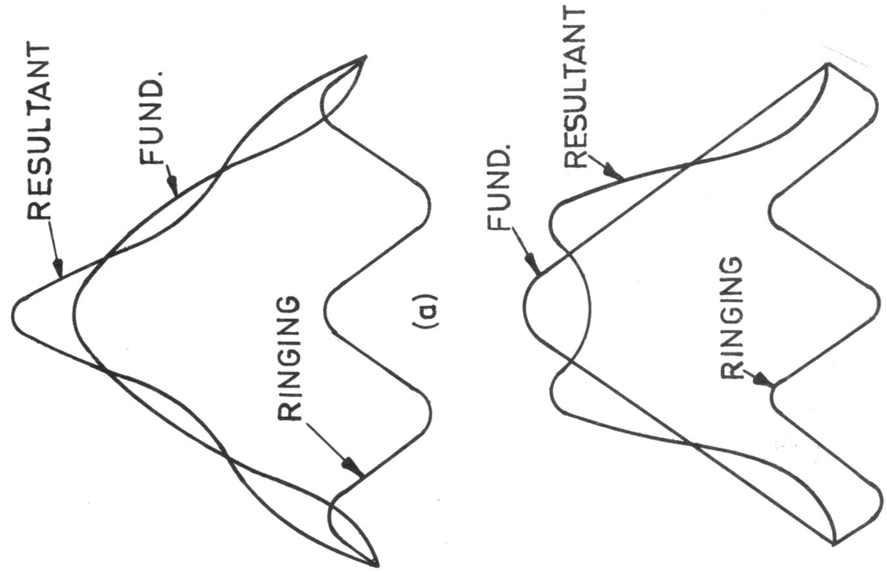
REPRESENTATION OF FIG.17.4. DURING RETRACE PERIOD AND INDICATING DIRECTION OF CURRENTS.

FIG.17.5.



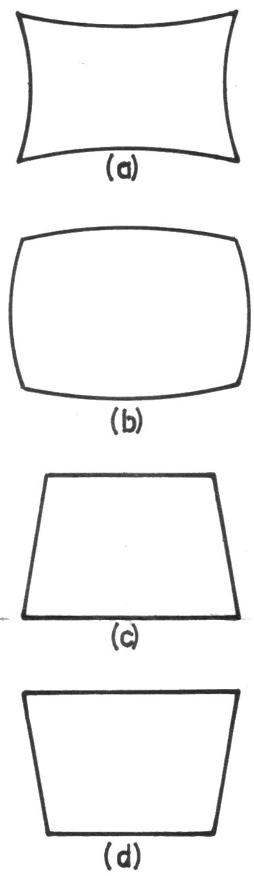
TYPICAL VOLTAGE WAVEFORM EXISTING ACROSS YOKE WINDINGS

FIG.17.12.



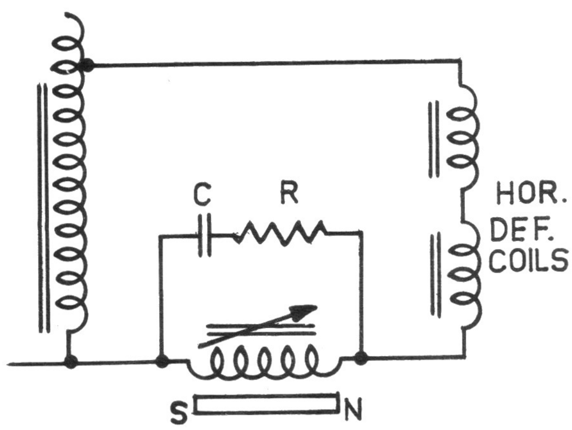
WHEN USING 5:1 PHASING RATIO.
(a) WAVEFORM POINT 1 FIG.17.9.
(b) WAVEFORM POINT 2 FIG.17.9.

FIG.17.11



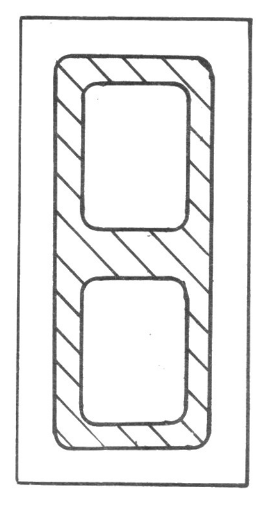
YOKE DISTORTION
(a) PIN CUSHION.
(b) BARREL
(c) & (d) TRAPEZIUM.

FIG.17.13.



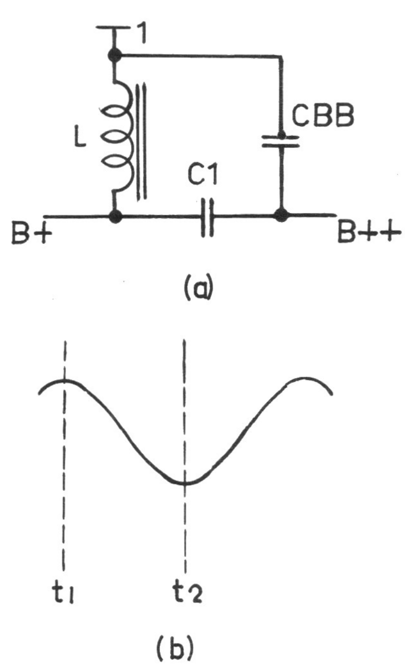
LINE LINEARITY CONTROL USING SATURATED REACTOR

FIG.17.14.



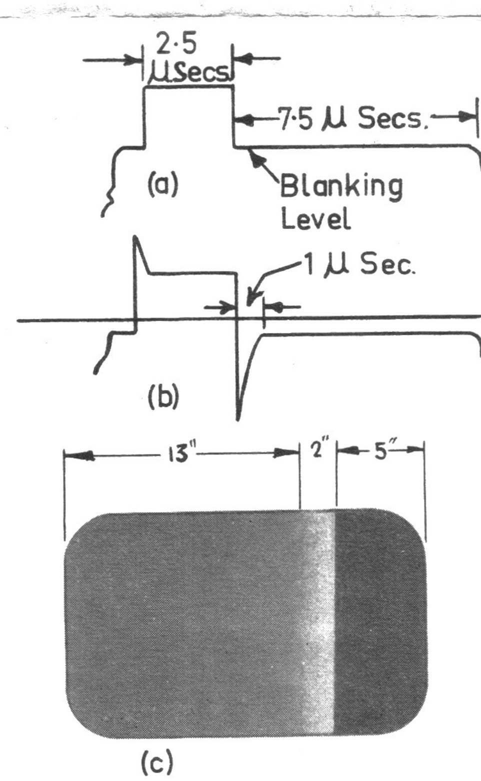
DEVELOPED VIEW OF SHORTED TURNS TYPE LINEARITY CONTROL.

FIG.17.15.



(a) LINEARISING CIRCUIT
(b) VOLTAGE WAVEFORM AT POINT 1 OF (a).

FIG. 17.16.

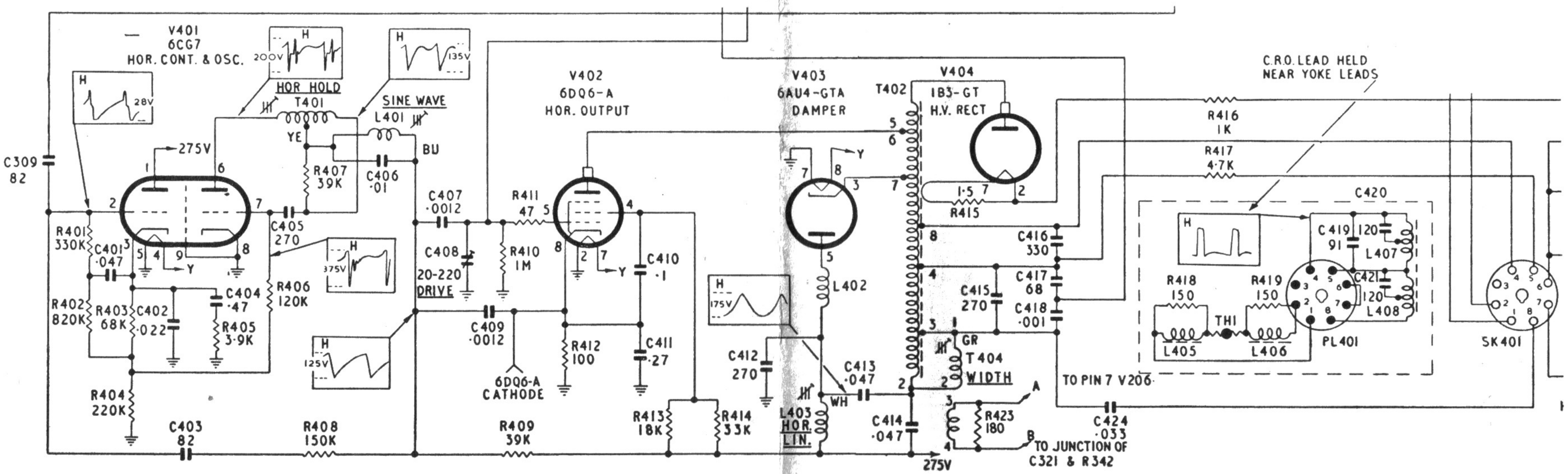


(a) Correct wave form of H pulse and blanking level.

(b) Incorrect wave form of H pulse and blanking level.

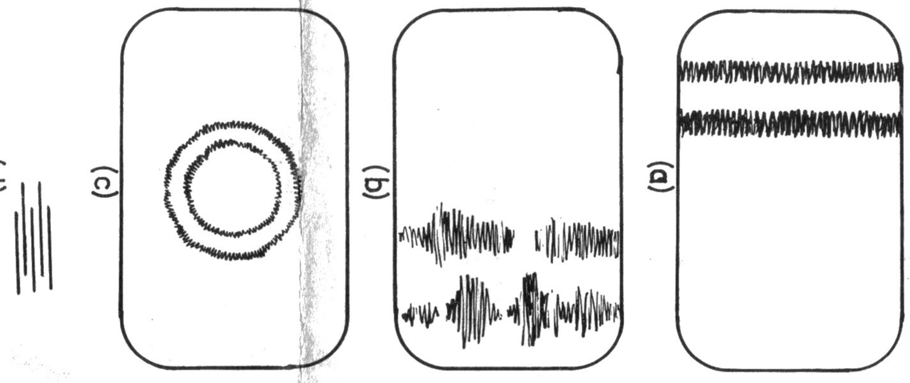
(c) Appearance of raster with condition at (b).

FIG. 17.17



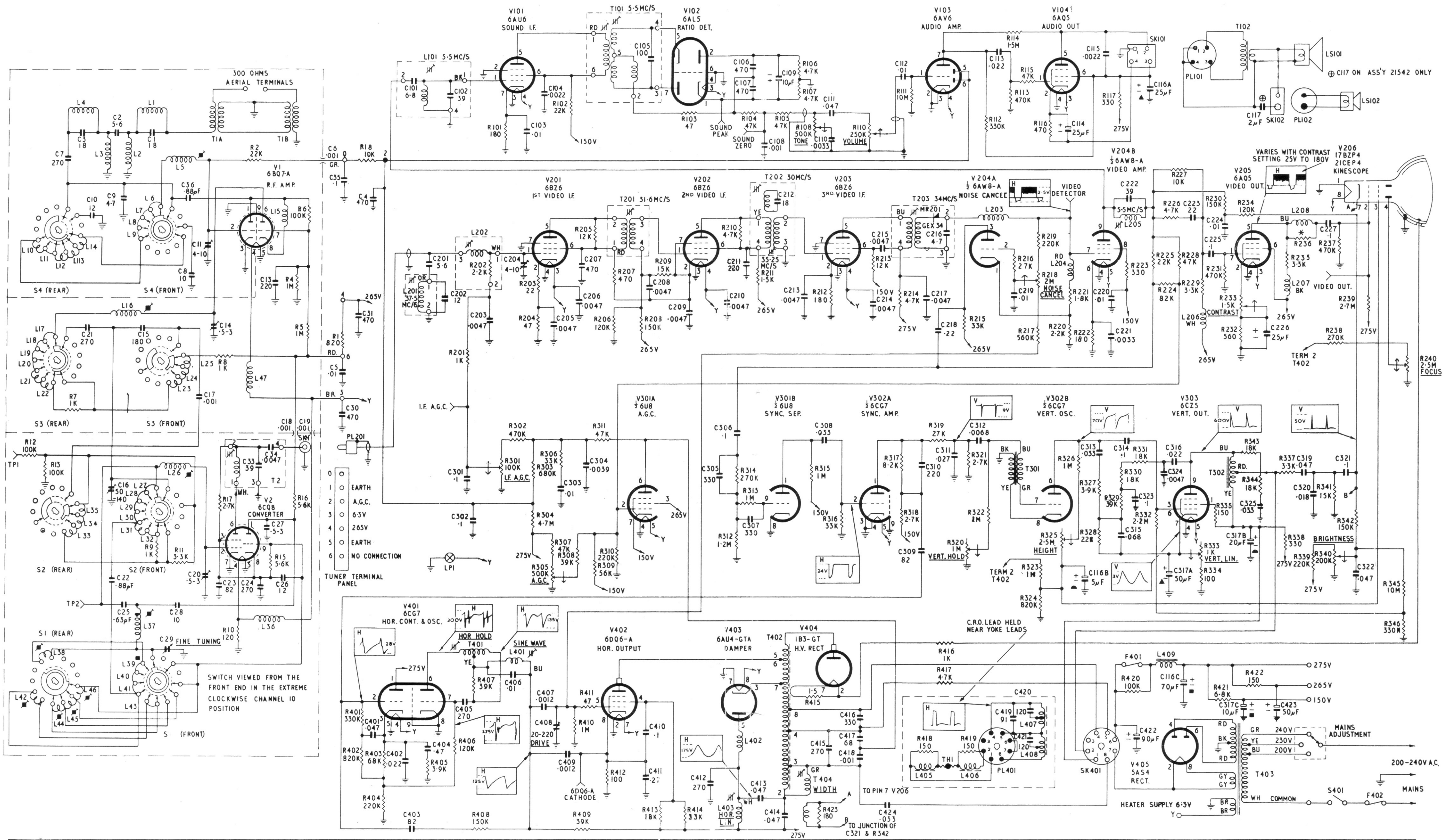
SWEEP GENERATOR AND HORIZONTAL OUTPUT STAGE
AS USED BY A.W.A. FOR THE INITIAL 110° DEF. RECEIVERS.

FIG. 17.18.



DISTURBANCES INDICATING
(a) BARKHAUSEN OSCILLATIONS.
(b) SNIVETS.
(c) COGWHEEL OR FRAYING.
(d) ALTERNATE LINES DISPLACED

FIG.17.19.



AMALGAMATED WIRELESS (AUSTRALASIA) LTD SYDNEY	DRN		TYPE- 220-1-2
CIRCUIT DIAGRAM T.V. RECEIVER RADIOLA 220-1-2	CKD		DRG- C.D. 1150
	APP		
	RLD		

CHANGES: R324 820K, R345 10M, R346 330K, ADDED 24/11/58

CIRCUIT A.W.A. TELEVISION RECEIVER MODELS 220-L & 221-C

In some chassis C202 was mounted in L201.

In some chassis the voltage rating on C418 was 600. These should be changed to a 1,600-volt rated capacitor.

In some chassis R345 and R346 were omitted.

The height-control circuit has been changed in the following stages:—

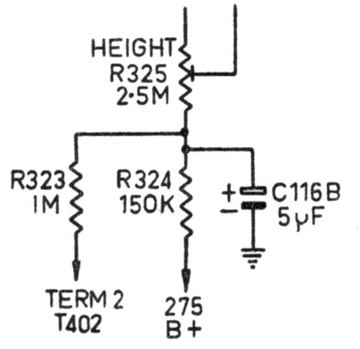


FIG A

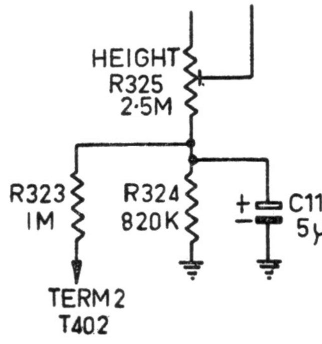


FIG B

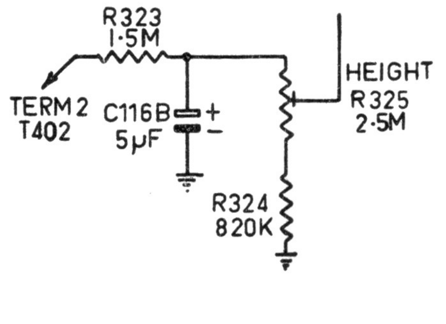
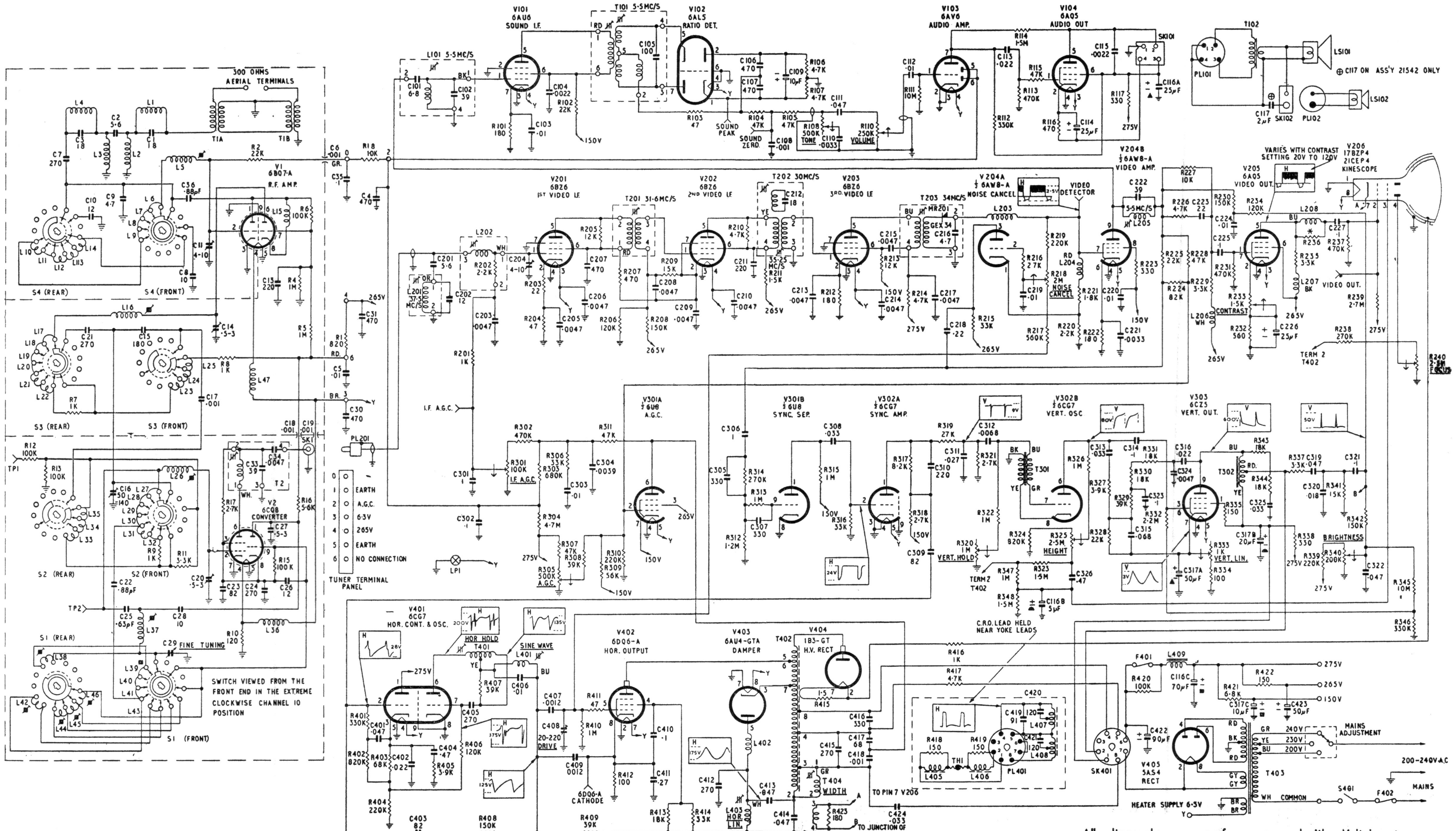


FIG C

R236*: In some chassis this was a 6.8K ohm resistor on which L208 was wound and a 22K ohm resistor was wired externally in parallel.



All voltages shown on waveforms measured with a Voltohmyst.

AMALGAMATED WIRELESS (AUSTRALASIA) LIMITED

TECHNICAL FEATURES OF THE VERTICAL CHASSIS

USED IN A.W.A. RADIOLA "DEEP IMAGE" TV

MODELS 220L and 221C

Much of the vertical chassis circuitry follows previous practice, so it is intended to refer mainly to the new and improved features. Where appropriate, the circuit will be compared with the present deluxe circuit (23 valve).

TUNER:

Apart from minor mechanical changes, the only significant change in the tuner is the use of a 6CQ8 instead of a 6U8. The 6CQ8 is a triode-tetrode, with various improvements relative to the 6U8. The main advantages to be expected in the tuner due to its use are slightly higher mixer gain and a slight decrease in the Channel 2 interference pattern.

VIDEO I.F.:

Three 6BZ6, remote-cut-off pentodes, are used, the 1st and 2nd stage being d.c. stacked to conserve B+ drain.

Coupling between tuner and the 1st stage is of the low-side C type instead of the link coupling previously used. This feature plus the use of a germanium diode as video detector and optimum operation of the I.F. valves results in the overall I.F. gain approaching closely that of the present deluxe 4 stage amplifier.

The use of the remote cut-off 6BZ6 pentodes assists in providing improved A.G.C. action. This will be further discussed in the section on the A.G.C. circuit.

VIDEO DETECTOR:

The use of a germanium diode (GEX34) as video detector is an innovation to A.W.A. chassis, although widely used by other manufacturers, here and overseas. The main advantages of a germanium diode compared with a thermionic diode in this application is the increased gain possible due to higher detection efficiency (lower diode capacitance) and the relative ease of shielding the detector and circuits.

VIDEO AMPLIFIER:

Two stages of video amplification are used, 6AW8A pentode section plus 6AQ5. This yields somewhat higher gain than is possible with the present single stage 12BY7, giving an overall sensitivity (aerial to kinescope) approximately equal to that of the present deluxe models.

Contrast control is by means of a variable resistor in the cathode circuit of the second video amplifier (6AQ5). This arrangement allows of greater flexibility in the placing of the contrast control with a possibility of styling arrangements not easily available using a high level contrast control as in the present deluxe chassis.

The 6AW8A plate circuit includes a sync. boost network which yields, at the plate, a video signal approx. four times greater than that at the 6AQ5 grid but with the higher frequencies attenuated. This "boosted" signal which is fed to the A.G.C. and sync. separation stages is effective in maintaining good sync. performance at very low input signals.

Coupling between the first and second stages is capacitive resulting in a loss of the d.c. component of the video signal. To partly compensate for this, the first video amplifier (6AW8A) plate is d.c. coupled to the kinescope cathode.

SOUND I.F. AND AUDIO:

Sound take-off to the sound I.F. is from the 6AW8A plate circuit, the gain at 5.5 Mc being sufficient to require the use of only one sound I.F. stage, 6AU6.

The ratio detector, 6AL5, feeds to the audio amplifier 6AV6 triode, which in turn is coupled to the audio output stage 6AQ5. The audio system is conventional and controls are provided for tone and volume. The mains switch is incorporated in the tone control and is of the push-pull type. The knob is pulled to swith ON and pushed to switch OFF. This can be done with the tone control at any setting.

NOISE CANCELLATION:

The noise cancellation stage uses the triode section of the 6AW8A. This gives improved sync. performance under conditions of heavy impulse interference, where noise pulses rise above the level of the sync. peaks. The cathode of the noise cancellation stage is fed with a fraction of the video detector output signal. The grid is biased so that the valve conducts at levels beyond sync. tips. The signal at the plate is therefore made up of amplified noise pulses, but of opposite polarity to those appearing on the boosted sync. signal at the 6AW8A pentode plate. These two signals are added in the appropriate ratios and fed to the sync. and A.G.C. circuits. The resultant signal consists of the video signal with the noise pulses cancelled out or greatly reduced.

Adjustment of the grid bias of the noise cancellation stage varies the level at which cancellation commences. Correct setting is with the level just above sync. peaks, the control being rotated until the sync. pulses start to compress and then backed off a little, so that no compression occurs.

A.G.C. AMPLIFIER:

Amplified A.G.C. is obtained by using a 6U8 pentode section. Operation is different from the present deluxe, in that the video signal is applied to the grid, rather than a d.c. signal corresponding to the sync. peak level. This avoids the use of separate vertical and horizontal sync. separators. Apart from this there are no advantages in the new arrangement.

Noticeable improvement has been made in the application of the developed A.G.C., however. The A.G.C. division to the video I.F. and the R.F. A.G.C. delay are selected so that the signal level at the mixer grid is lower than in the present deluxe with medium and high aerial inputs. This reduces the Channel 2 effect (2.25 Mc beat) to negligible proportions under all conditions of input.

The use of the remote cut-off 6BZ6 assists in this action, the gain versus bias characteristic being such as to give good gain reduction with increase of low signal levels, and little additional reduction at levels above approx. 1 mV, where the tuner A.G.C. action commences and takes control.

In order to achieve this performance with normal variation in valve characteristics, the A.G.C. division to the video I.F. is made variable. This allows of optimum setting of the I.F. bias, resulting in freedom from the Channel 2 effect on the one hand and minimum snow with weak signals on the other.

VERT. SWEEP CIRCUIT:

The change to 110° deflection, increases the demand on the output stages of the vertical and horizontal deflection circuits. In the vertical output, this necessitates the use of a 6CZ5 instead of a 6AQ5. The 6CZ5 is a valve with higher peak plate voltage rating (2,200 volts) and other improvements. It has been designed especially for this application.

Apart from this change, and the necessary changes to circuit valves, the vertical circuit is similar to the existing 90° circuits.

HORIZONTAL SWEEP CIRCUIT:

As in the vertical deflection circuit, the horizontal deflection circuit is similar to the present 90° circuit, except for changes necessary to provide the increased deflection current. The 6AX4GT has been replaced by the 6AU4GTA, which has higher voltage and current ratings.

The horizontal linearity control has a considerable effect on the circuit efficiency. Incorrect adjustment can result in valve ratings being exceeded. To avoid this and allow the adjustment of this control in the absence of a suitable or reliable pattern, it is recommended that the linearity control be set to give minimum 6DQ6A cathode voltage. A test point connected to the 6DQ6A cathode allows this to be done readily, using any conventional D.C. voltmeter.

Horizontal retrace blanking is employed to prevent vertical white line or background shading appearing during line retrace. This is achieved by the use of a small additional winding in the width coil, the voltage across this winding being applied to the kinescope cathode so that the beam current is biased off during the horizontal retrace period.

This is in addition to the customary vertical retrace blanking.

YOKE:

The contour of the 110° kinescope, necessary to avoid neck-shadow at the wide deflection angle used, calls for more shaping of the yoke windings than in the 90° yoke. This factor results in more inherent "pincushion" distortion in the 110° design. To overcome this, four correcting magnets are built into the yoke assembly. There is also more tendency to "cross talk" ringing and this is counteracted by the use of additional balancing capacitors across the top half of each horizontal winding.

Increased deflection power and more compact yoke assembly result in higher temperature rise in the yoke. This results in undue change in the resistance of the vertical windings with a corresponding reduction in picture height. To overcome this, a thermistor (negative temperature-coefficient resistor) is inserted in series with the vertical windings and in close thermal contact with them. The resistance of the thermistor decreases with temperature in such a way as to maintain substantially constant deflection.

POWER SUPPLY:

The power supply is conventional and uses one 5AS4 rectifier. Fuses are provided in the mains and B+ line.

A thick shorting strap on the power transformer, minimises the external field.

MISCELLANEOUS FEATURES:

The chassis is mounted vertically with the valves on the rear side. This arrangement allows better use of the reduced depth of the cabinet, made possible by the 110° kinescope. The wiring side of the chassis is accessible only on removel of the chassis, but this is a simple operation. The chassis may be removed separately, or together with the kinescope as a unit assembly.

A label on the chassis indicates the position of all major components such as valves, transformers, coils, controls and test points.

Test points are provided, allowing a check of video and sound I.F. alignment video amplifier performance and A.G.C. operation without removing the chassis from the cabinet.