ULTRA T22 TELEVISION RECEIVER

Vision and vision-sound table model with 7¾ by 6¾ in. direct viewed, black and white picture. Superhet circuit, 18 valves. Price 28 gns., aerial and installation extra.

THE input from the feeder is through a balanced transformer to the grid of V1, a common sound and vision amplifier, use being made of an SP41 screened pentode. This is followed by transformer coupling to the frequency changer, V2. This is an AC/TH1 triode hexode with a split anode load in the hexode section. The vision channel is taken through a transformer to the grid of V3, another SP41 screened pentode, used as the first vision IF amplifier. In addition, there is a tuned anode circuit which couples the hexode through a condenser to the grid of V9, a VP41, the first sound IF amplifier.

Coupling from V3 to V4, second vision IF amplifier, is through a bandpass circuit, V4 being another SP41. Between V4 and V5, the final IF amplifier (another SP41) there is a single peak circuit. A further bandpass transformer connects V5 to the demodulation diode V6.

A split diode load and filter network is used with V6, the load being directly coupled to V7, an SP42 screened pentode used as a video stage.

The output load for the video stage comprises a load resistance and correction inductance, the network being capacity coupled to the grid of the cathode tube.

DC restoration is established by a further diode, V8, connected across a load resistance between the grid and cathode of the tube.

Sound Channel

Reverting to the sound channel, the first IF amplifier (V9) is coupled through a single peak circuit to V10, a VP41 variable-mu HF pentode which works into an AC5/Pen/DD combined diode-pentode, V11. A single peak circuit forms the input to the diode and the coupling to the control grid of the output pentode is taken through a filter circuit.

TWO chassis are used in this receiver, one carrying vision and sound channels, and the other the power and scanning sections. To aid reference this review is also sectionalised as follows :—

Vision unit, circuit, Fault-Finder, pages 42, 43.

Scanning unit, circuit, Fault-Finder, page 45.

Adjustment Notes, page 46.

Alignment Notes, page 46.

Gain control of both channels is effected through variable resistances. Vision gain is controlled on V3 and forms the contrast adjustment of the set.

Contrary to general practice, the sound output is controlled on the H.F. side, actually on the cathode of V10.

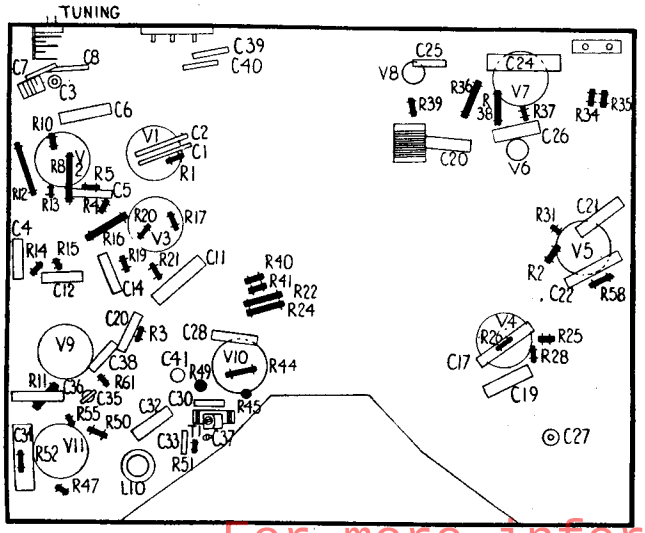
CONSTRUCTIONAL FEATURES

IN the main, our model was found to agree very accurately with the maker's circuits. There were, however, one or two minor alterations, and these have been included in the circuits reproduced.

(*Continued in column 1, page 44.*)

VISION UNIT VALVES

Valve.	Type.	Anode.	Screen.	Cathode.
	All Mazda.			
1 ..	SP41 ..	170 ..	170 ..	1.5
2 ..	ACTH1	175 .. 60 (sc.)	85 ..	2.6
3 ..	SP41 ..	183 ..	183 ..	2 (minimum)
4 ..	SP41 ..	195 ..	195 ..	1.75
5 ..	SP41 ..	195 ..	195 ..	1.75
6 ..	D1 ..	Diode only		
7 ..	SP42 ..	230 ..	130 ..	1
8 ..	D1 ..	Diode only		
9 ..	VP41 ..	163 ..	163 ..	2
10 ..	VP41 ..	200 ..	200 ..	3 (minimum)
11 ..	AC5/Pen DD	197 ..	203 ..	6.5



Right, the vision and sound chassis circuit, shown divided for reasons of presentation. The circuit of the power and scanning chassis is on page 45.

Left, under-chassis layout of the vision section. Top "deck" view showing most of the trimmers is with the ganging notes on page 46.

FAULT-FINDER

If the brilliance adjustment has little effect, either a faulty tube or tube supply circuit is indicated. With a picture present, correct tube voltages and tube, lack of intensity means low gain or output from the vision channel.

If bad synchronism is accompanied by low picture level, this is an indication of low gain. Conversely, if the hold on line and frame is strong and the picture level low, attention should be directed to the tube supply and the tube itself.

Lack of quality or definition is generally due to incorrect ganging. If the picture has strong following black on a leading white, suspect the oscillator setting. If this has no effect there may be a bad "ring" due to mis-match of the feeder or an external reflection.

In tests below italic, bracketed figures refer to points on circuit.

Output Stage (V11).

Inject 2 volts AF V11 grid. Check :—

Voltages : *E*—(*14*), 197; *E*—(*15*), 203.

Resistances : L5, 280; *E*—(*15*), 500,000 ohms.

Second IF Stage (V10).

Inject 2.3 mcs. V10 grid and adjust T1. If defective, check :—

Voltages : *E*—(*16*), 200; *E*—(*17*), 200.

Resistances : (*4*)—(*16*), 1,000; *E*—(*18*), 100,000 ohms.

First IF Stage (V9).

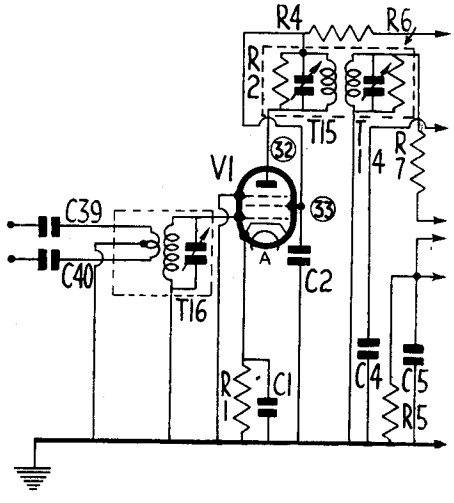
Inject 2.3 mcs. V9 grid and adjust T2. If defective, check :—

Voltages : *E*—(*19*), 163; *E*—(20), 163.

Resistances : (*4*)—(*19*), 5,000 ohms. Check R49 and R43.

Mixer Stage (V2).

Short oscillator section, inject 2.3 mcs. at V2 grid, and adjust T3. If defective refer to instructions for vision channel, V2.



Video Stage (V7).

Remove EHT rectifier and connect output meter to V7 anode through isolating condenser.

Inject 0.5 volt AF V7 grid. If defective, check :—

Voltages : (*21*), 230; (*22*), 130.

Resistances : (*2*)—(*21*), 3,000; (*4*)—(*22*), 15,000 ohms.

Third IF Stage (V5).

Inject 4.6 mcs. grid V5 and trim T4 and

T5. If defective, check :—
Voltages : (*23*), 195; (*25*), 195.
Resistances : (*4*)—(*23*), 1,000; *E*—(*24*), 2,000 ohms.

Second IF Stage (V4).
Inject 4.81 mcs. and trim T7. Then proceed as for V5. Resistance E—(*25*), however, is very low.

First IF Stage (V3).
Inject 4.45 mcs. V3 grid and trim T8 and T9. If defective, check :—
Voltages : (*26*), 183; (*27*), 183.
Resistance : (*4*)—(*26*), 5,000 ohms.

Mixer Stage (V2).
With oscillator shorted, inject 4.28 mcs. V2 grid, trim T11, T12. If defective, check :—
Voltages : (*28*), 175; (*29*), 85.
Resistances : (*4*)—(*28*), 3,000; (*4*)—(*29*), 23,000 ohms.

Oscillator.
Inject 45 mcs. V2 grid and unshort oscillator, adjusting until signal is obtained. Inject 41.5 mcs. and note output from speaker. If no output on either channel, check :—
Voltage (*30*), 60.
Resistance : *E*—(*31*), 25,000 ohms.
If no signals, check oscillator network.

Signal Amplifier (V1).
Inject 45 mcs. V1 grid and trim T14 and T15. If defective, check :—
Voltages : (*32*), 170; (*33*), 170.
Resistance : (*4*)—(*32*), 5,000 ohms.

Input.
Inject 45 mcs. on feeder sockets and trim T16. If defective, check input transformer.

RESISTANCES (Vision)

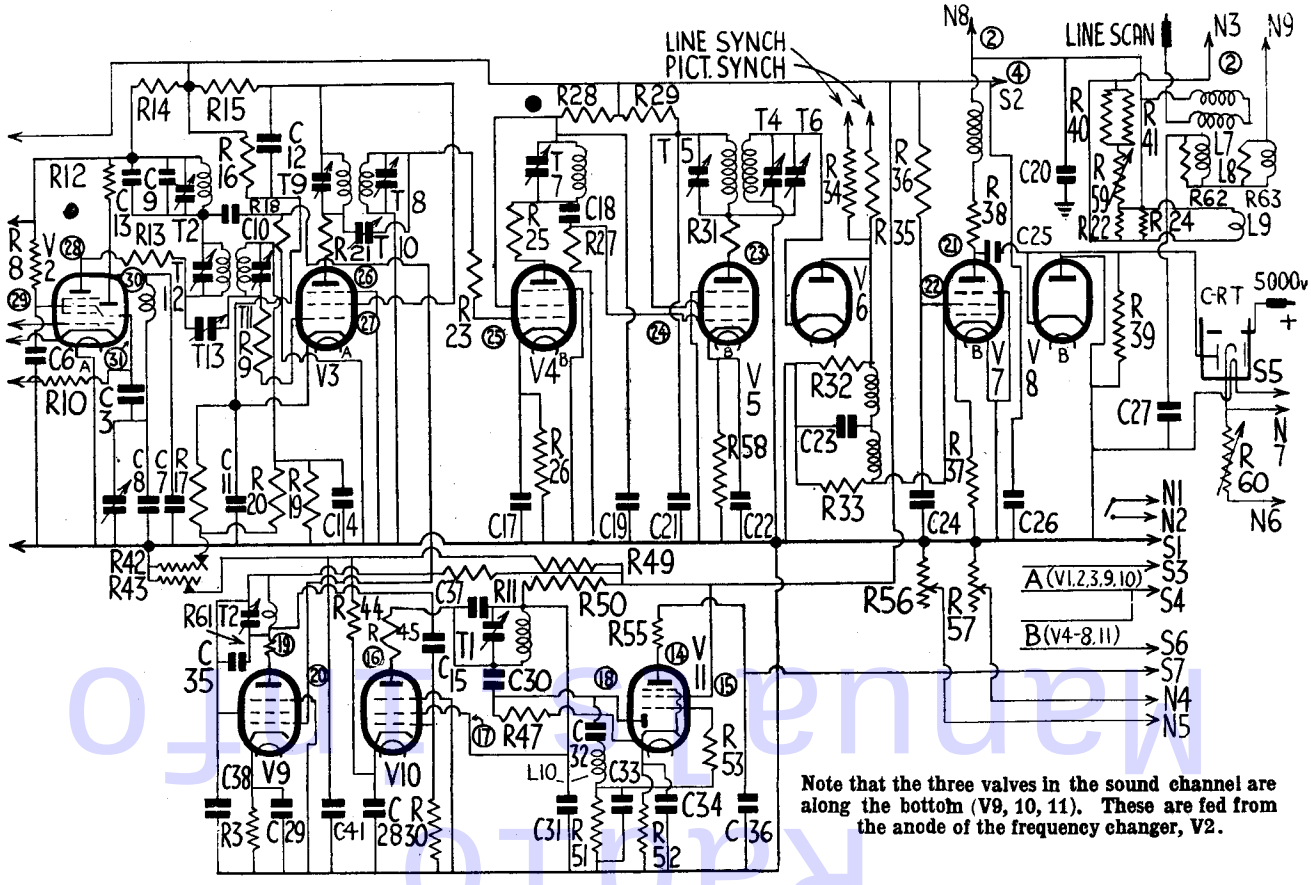
		Ohms
1	V1 cathode bias	160
2	Signal trans. shunt	2,000
3	V9 cathode bias	200
4	V1 anode decouple	5,000
5	V2 cathode bias	200
6	Signal trans. sec. shunt	3,000
7	V2 grid stopper	60
8	V2 screen feed	20,000
9	V3 grid stopper	60
10	Osc. grid leak	25,000
11	V9 screen feed	5,000
12	Osc. anode load	25,000
13	V2 anode stopper	60
14	V2 screen decouple	3,000
15	V3 decouple	5,000
16	V3 cathode pot. (part)	80,000
17	V3 cathode fixed bias.	160
18	V9 grid leak	25,000
19	V3 bias network (part)	10,000
20	V3 bias network (part)	640
21	V3 anode stopper	60
22	Focus coil shunt (part)	3,000
23	V4 grid stopper	60
24	Focus coil shunt (part)	3,000
25	V4 anode stopper	60
26	V4 cathode bias	160
27	V5 grid resistance	2,000
28	V4 decouple	1,000
29	V5 decouple	1,000
30	Grid leak V10	50,000
31	V5 anode stopper	60
32	Demodulation load (part)	3,000
33	Demodulation load (part)	3,000
34	Line synch. filter	20,000
35	Frame synch. filter	20,000
36	V7 screen feed	15,000
37	V7 cathode bias	30
38	V7 anode load	3,000
39	V8 diode load	1 meg.
40	Focus feed (part)	1,000
41	Focus feed (part)	1,000
42	Contrast control	10,000
43	Volume control	10.000
44	V10 cathode bias	200
45	V10 anode stopper	60
47	Sound demod. diode load	100,000
49	V10 cathode pot. (part)	50,000
50	V10 decouple	1,000
51	V11 grid leak	500,000
52	V11 cathode bias	160
53	V11 grid stopper	1,000

Resistances (continued)

55	V11 anode stopper	60
56	Line hold	2,000
57	Frame hold	2,000
59	Focus	2,000
60	Brilliance	50,000
61	V9 anode stopper	60
62	Frame coil shunt	10,000
63	Frame coil shunt	10,000

CONDENSERS (Vision)

		Mfds.
1	V1 cathode shunt	.01
2	V1 screen decouple	.01
3	Osc. grid	.00005
4	Osc. anode decouple	.1
5	V2 cathode shunt	.1
6	V2 screen decouple	.1
7	Osc. anode shunt	.0001
8	Osc. fixed tune.	.00005
9	Sound IF fixed tune	.0003
10	Sound IF coupling	.0002
11	V3 cathode shunt	.1
12	V3 decouple	.1
13	Sound IF fixed tune	.00007
14	V3 cathode shunt	.1
15	Sound IF coupling	.0002
17	V4 cathode shunt	.1
18	V4-V5 coupling.	.0002
19	V4 decouple	.1
20	HT line shunt	.1
21	V5 decouple	.1
22	V5 cathode shunt	.1
23	IF filter	.00005
24	V7 screen decouple	2
25	Video coupling	.002
26	HT line shunt	.1
27	Frame scan isolating	32
28	V10 cathode shunt	.1
29	V9 cathode shunt	.1
30	V10-V11 coupling	.0002
31	V10 decouple	.1
32	AF coupling	.1
33	Diode load shunt	.0002
34	V11 cathode shunt	50
35	V9 anode fixed tune	.00001
36	V11 anode shunt	.01
37	V10 anode fixed tune	.00001
38	V9 decouple	.1
39	Aerial primy. series tune	.0001
40	Aerial primy. series tune	.0001
41	Sound gain control shunt	.1



Note that the three valves in the sound channel are along the bottom (V9, 10, 11). These are fed from the anode of the frequency changer, V2.

(*Continued from page 42*)

In the original circuit no series tune condensers were shown in the feeder lead—i.e., C39 and C40. Similarly, there was no decoupling condenser C38 on the screen of V9.

In the time base there are certain modifications, both the frame coils being shunted with 10,000-ohm resistances. The screen of the line amplifier, V5, in the scanning unit is fed from an 80,000-ohm resistance. shunted with a further 20,000 ohms, R26.

When taking voltage measurements in the time base, before measuring the anode voltage of the line and frame amplifiers, it is essential to remove the two gas relays or short the grids to earth. *It must be remembered that the fly-back voltage at the anode of the line amplifier is very high when the gas relay is generating, and care must be taken with this electrode.*

If it is desired to check the operating conditions of the valves, most of which have British Octal bases, it is recommended that anode, screen and cathode voltages be measured.

There is no need to measure the anode currents.

Chassis Removal

There are two distinct chassis, the upper one carrying the vision and sound receivers. Removal is accomplished in the following manner.

First of all, the six knobs, all of which are secured by grub screws, must be removed from the front. Next release the two retaining bolts from the back of the underside of the top deck.

Pull out two multiple plug connectors from the lower chassis, the plug by the side of the E.H.T. rectifier, the plug on the transformer strip and the two plugs at the back of the upper chassis.

The lower chassis is released by removing the four retaining bolts.

Tube Removal

Remove the main anode connection thimble and release two of the springs from the front retaining ring and then withdraw the base connection socket.

Release two of the neck-centring brackets. The tube can then be withdrawn.

ULTRA T22: SCANNING UNIT

THE C.R. tube is a type scanned magnetically on both line and frame. Low impedance scanning is used on the line through a specially constructed transformer, but the frame scanning is at high impedance.

Line generation is effected through V4, a T41 gas relay, with split condenser coupling to V5, the line amplifier. This is an AC6/Pen. super power pentode, the anode circuit containing the line transformer which steps down the voltage to the line coils. There is the usual picture form correction network with a pre-set adjustment on the resistance element.

Frame scanning is by means of another T41 gas relay, V6, with split condenser coupling to the grid of V7, the frame amplifier, an AC5/Pen. Resistance capacity coupling is used between this valve and the frame coils.

Both scan circuits are quite normal and call for no comment. The frame scan circuit follows the general practice of putting the flyback resistance on the anode side.

High voltage supply is by a single high voltage rectifier, V3, with single condenser and resistance for smoothing.

The remainder of the power supply is provided by two separate full-wave rectifiers which supply the focusing coil and the sound and vision channels. These are V1 and V2, both types UU4.

Smoothing is obtained by electrolytic condensers, a smoothing choke and the speaker field winding.

Control System

Line speed and frame speed form the line and frame hold controls and take the gas relay charge circuits, that is, the anode circuits of V4 and V6. These controls are located at the back of the cabinet and are not normally used.

Line speed and frame speed form the line and frame hold controls and take the form of variable bias resistances for the two gas relays.

Brilliance is controlled by altering the bias on the tube circuit. Here there are two adjustments, one the brilliance control and the other a further series connected resistance on the lower chassis in the form of a pre-set.

The cathode of the CR tube is returned to the earth line through a resistance network, part of which is formed by these variable resistances and in this way the necessary negative bias is obtained.

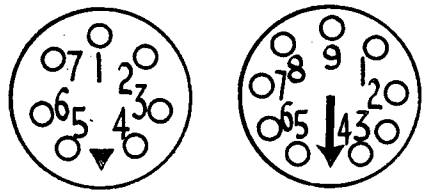
The focussing current is varied by means of a single variable resistance forming

SCANNING UNIT VALVES

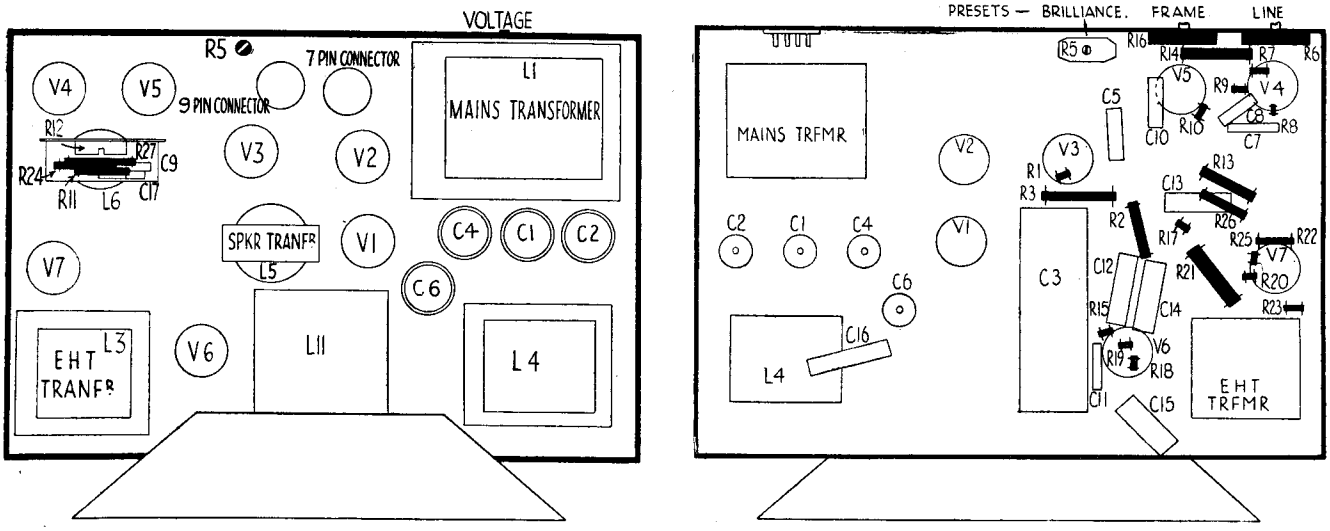
Note warning in column one.

Valve.	Type.	Electrode.	Voltage.
	All Mazda.		
1 ..	UU4	Heater ..	355
2 ..	UU4	Heater ..	280
3 ..	U21	Heater ..	5,000
4 ..	T41	Anode ..	80
5 ..	AC6/Pen ..	Anode ..	260
		Screen ..	215
		Cathode ..	7
6 ..	T41	Anode ..	80
7 ..	AC5/Pen ..	Anode ..	140
		Screen ..	220
		Cathode ..	9

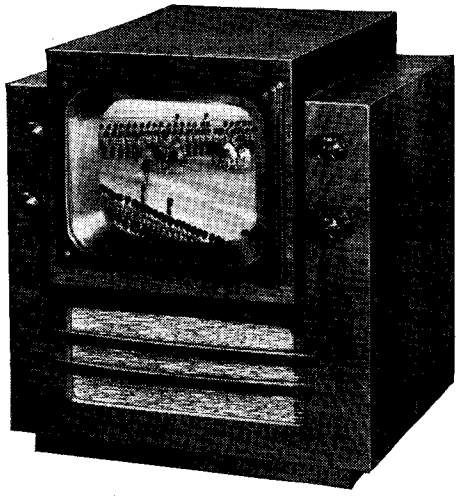
The cathode-ray tube is the Mazda CRM91.



Connections between vision and scanning chassis are by 9 and 7 pin plugs and are identified by letters N and S respectively in the circuits. This diagram of the valveholders as seen from underside of the vision chassis locates the numbers.



Top (left) and underside layout diagrams of the scanning and power chassis. The circuit for this section is on the facing page and the relative description above.



The Ultra T22 television receiver. Adjustment instructions and alignment notes are on page 46.

part of a resistance network, this control being the focus adjustment of the set.

Synchronising System

Use is made of the "less negative" system, the grids of the gas relay being connected to the top of the diode load.

The greater the signal modulation voltage the more negative will the voltage on the diode load become. At black level it will have a definite value.

On the synchronising signal it falls below black level and becomes less negative (or positive with respect to black level) and accordingly the gas tubes fire. There is no special or elaborate filter circuit between the relays, the frame grid circuit simply being shunted by a condenser.

SCANNING UNIT FAULT-FINDER

See preliminary test notes, page 42.

Power Test.—To make sure that the main power supply circuits are correct check the following voltages. The italic, bracketed figures refer to the test points indicated on the circuit diagrams.

(*1*) 360 volts, (*2*) 330 volts, (*3*) 280 volts, (*4*) 213 volts, (*5*) 197 volts.

If defective, check the following resistances: L4, 230; L5, 280; L11, 600 ohms.

Frame Scan (V6 and V7).

Remove V6 and inject 5 volts AF to V7 grid with output meter connected to anode through isolating condenser. If defective, check :—

Voltages *E*–(*6*), 140; *E*–(*7*), 220.

Resistances: (*2*)–(*6*), 3,500 ohms; (*2*)–(*7*), (8,000 ohms); *E*–(*8*), 1 megohm.

Insert V6 and obtain reading on output meter. If defective, check :--

Voltage: *E*–(*9*), 80 volts, and associated network.

Line Scan (V4 and V5).

Proceed as for frame scan, noting the following :—

Voltages: *E*–(*10*), 260; **E**–(*11*), 215.

Resistances: (*2*)–(*10*), 83 ohms; (*2*)–(*11*), 5,800 ohms; *E*–(*13*), 1 megohm.

CONDENSERS (Scanning)

		Mfds.
1	HT smoothing	8
2	HT smoothing	8
3	EHT smoothing	.1
4	HT smoothing	32
5	CR tube bias shunt	.1
6	HT smoothing	32
7	Line charge (part)	.01
8	Line charge (part)	.01
9	Form correction (part)	.01
10	V5 screen decouple	.1
11	Frame synch. input filter	.005
12	Frame charge (part)	.5
13	Frame charge (part)	.5
14	Frame charge (part)	.5
15	V6 bias shunt	50
16	Focus circuit shunt	20
17	Form correction (part)	.025

RESISTANCES (Scanning)

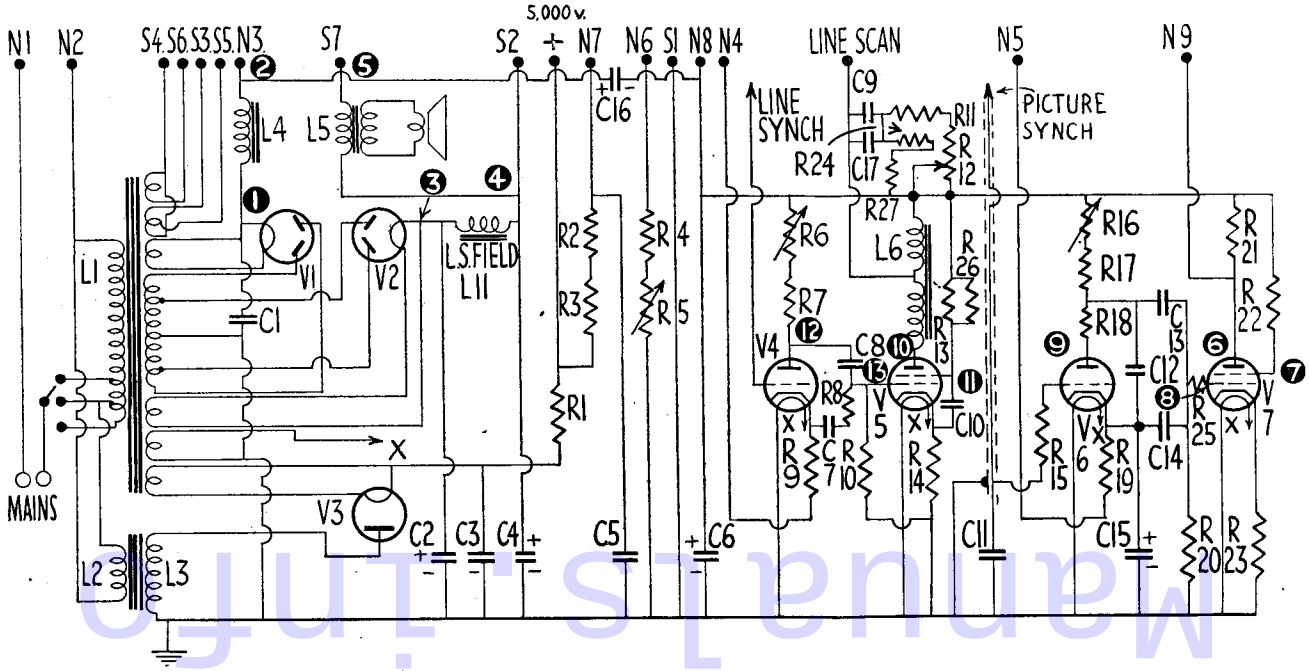
		Ohms
1	EHT tube feed	250,000
2	EHT load (part)	5 meg.
3	EHT load (part)	5 meg.
4	CR tube bias (part)	20,000
5	CR tube bias pre-set	150,000
6	Line output control	50,000
7	Line charge	60,000
8	Line fly-back	250
9	Line relay bias	1,000

Resistances (continued)

10	V5 grid leak	1 meg.
11	Form correction (part)	1,000
12	Form correction pre-set	1,000
13	V5 screen decouple	8,000
14	V5 cathode bias	100
15	V6 grid filter	5,000
16	Frame output control	100,000
17	Frame charge	70,000
18	Frame fly-back	250
19	V6 cathode bias	1,000
20	V7 grid leak	1 meg.
21	V7 anode load	3,500
22	V7 screen feed (part)	8,000
23	V7 cathode bias	160
24	Form correction (part)	1,000
25	V7 grid stopper	60
26	V5 screen feed (part)	20,000

WINDINGS

L.	Where measured.	Ohms.
1 & 2	Mains plug	2.2
3	V3 anode and chassis	7,000
4	On tags	230
5	On tags	280
6	On tags	83
7	Across scan coil	11
8	Across scan coil	810
9	Across R42	211
10	On tags	47
11	On tags	600



Three rectifiers and four time base valves are incorporated in the scanning and power chassis, the circuit of which is given above. For interconnection details see valveholder diagrams on facing page.

Ultra T22: Adjustments

Format Adjustment.

The amplitude of the line and frame sweep is controlled by R6 and R16 located at the back of the scanning chassis. These controls are adjusted until the picture fully occupies the mask area.

Centring is automatic, provided that the tube neck lies correctly in the scan coils. As the clearance is small no adjustment is necessary.

Focus Control.

If the focus control will not focus accurately it may be due to the fact that the coil is not in the correct position on the tube neck. The whole coil can be moved on the supporting frame by slackening the bolts at the side.

This is correctly adjusted when the set leaves the factory and should only require attention when a new tube is fitted.

Brilliance.

Brilliance is controlled by the bias on the tube. There are two variable resistances for this purpose, R60 and R5, the latter being a pre-set.

If, under operating conditions, the white level is just too low with the set brilliance control advanced to maximum, the pre-set should be slightly adjusted.

Form Adjustment.

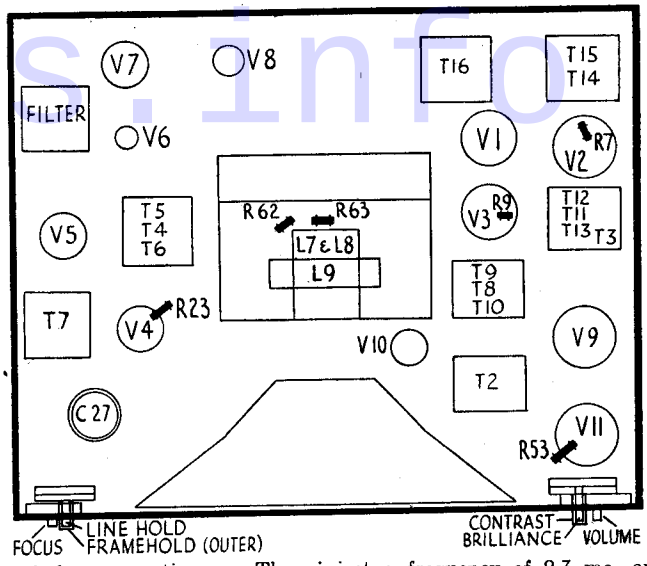
The line output waveform is controlled by a correction circuit on the line output transformer. This is adjusted by the manufacturers and should not normally require attention.

The resistance R12 is the variable element of the correction circuit. Should adjustment be necessary, this must be varied until the edge of the picture assumes a correct undistorted shape without tendency to fold or become extended.

Synchronising Adjustment.

As the set uses the " less negative " system, there is no pre-set datum line control, the natural line and frame speed controls being the adjustments of the set, that is R56 and R57.

Synchronising trouble is, then, only likely to be due to an obvious fault in the synchronising circuit or failure of the bonding on the screened lead to the gas relay grid.



This diagram of the top of the vision chassis shows the locations of the trimmers. Actually, the trimmers are vertical and on the sides of the cans. On the drawing they are given in correct top-to-bottom order on each can. T1 is under the chassis.

Alignment

As a safety precaution, before connecting the generator to the set, remove the EHT rectifier valve and carefully insulate and anchor the lead to the top cap. There is then no danger from EHT voltages.

When trimming the vision set two indicators may be used. An output meter can be connected between the anode of V7 and chassis through an isolating condenser. Alternatively, if the engineer is experienced and knows the trimming can be carried out with perfect safety with the EHT on and the CR tube operating, the tube itself can be used as in indicator. A modulated generator signal gives horizontal bands on the screen, the intensity of which is an indication of output.

Sound Channel.

As the frequencies are high, it is advisable to short the oscillator valve grid to chassis by a very short lead, or connect it to earth through a large condenser (0.1 mfd).

It is vitally important to use an accurately calibrated generator.

Tune the generator to 2.3 mc. and inject to the grid of V9. Adjust T1 and T2 for maximum.

Then inject a frequency of 2.3 mc. on the grid of V2 and adjust T1 for maximum.

Resonance should be determined with an output meter.

Vision Channel.

Inject at V5 grid a frequency of 4.6 mc. and adjust T4 and T5.

Change the frequency to 4 mc. and adjust the top coupling trimmer T6.

Inject at grid V4 a frequency of 4.81 mc. and adjust T7 for maximum.

Inject at grid V3 a frequency of 4.45 mc. and adjust T8 and T9.

Change the frequency to 3.88 and adjust the top coupling trimmer T10.

Inject at the grid of V2 a frequency of 4.28 mc. and adjust T11 and T12.

Change the frequency to 3.95 mc. and adjust top coupling trimmer T13.

Unshort the oscillator section and inject at V1 grid a frequency of 45 mc. and adjust T14 and T15.

It should be noted that no output will be obtained until the receiver oscillator tuning condenser is correctly adjusted for reception at 45 mc.

Connect the generator to the input terminals of the set and adjust T16.

Replacement Condensers.—Exact replacements available from A. H. Hunt, Ltd., are: for either C4, 6 or (vision chasis) 27, unit 3058, 9s. 6d.; for C2, 3055, 6s.; C1, 3053, 6s.; C15, 2915, 1s. 9d.; C16, 1955, 2s., and for C24 (vision unit), 2964, 1s. 10d.

(*Continued from page* 25)

Long Waves.—Tune set and oscillator to 1,300 metres (230 kc.) and adjust T9 and then T10 for maximum.

Tune set and oscillator to 1,700 metres (176.5 kc.) and adjust P2 for maximum, simultaneously rocking the gang.

Repeat both operations until no further improvement results.

Short Waves.—Tune set and oscillator to 19 metres (15.7 mc.), screw T5 right up and then unscrew it until the second resonance point is obtained. Then adjust T6 for maximum.

The short wave padding is fixed and the trimming should be checked at 30 and 50 metres.

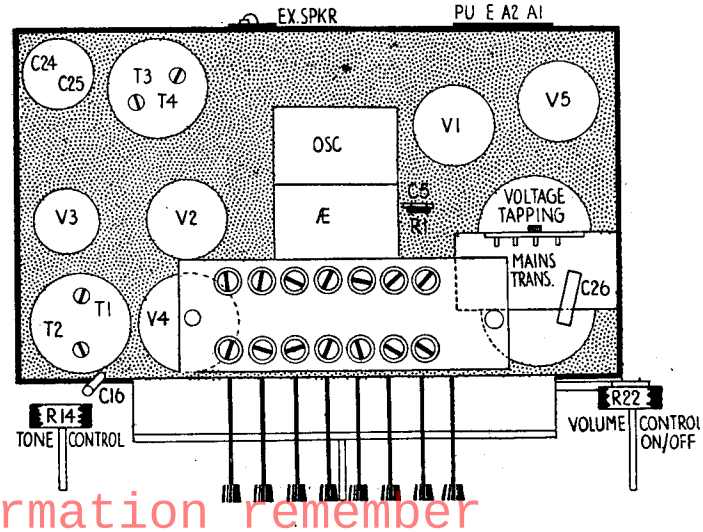
Push-button Adjustment

The push-button controls are located under a bakelite cover on the top of the cabinet.

The two rows of trimmers have an indicating plate showing the waveranges they cover. The medium band is divided into five groups, and there are two long-wave buttons. The row of trimmer adjustment screws nearer the front of the cabinet control the aerial circuit, and the back row the oscillator circuit.

To adjust a station on any particular button, the buttons are counted from the left and the appropriate number is found on the trimmer assembly. The back trimmer (oscillator) is then adjusted for resonance and the front trimmer adjusted for maximum output.

Ultra Push-Button 205



Top of chassis layout diagram of the 205 showing the positions of valves and other parts. The push-button trimmers are accessible through a panel on the cabinet top.