FERGUSON
372A, 373RG, 374RG, 375RG

SIX-VALVE four-waveband receivers covering long, medium, short, and VHF-FM bands. Suitable for 200-250V AC only.

Table model 372A was released in September, 1955, at £29 8s. including £8 3s. 5d. tax. Small bureau radiogram model 373RG was released in October, 1955, and console radiogram model 374RG in November, 1955; both were listed at £60 18s. including £16 18s. 7d. tax. Large bureau radiogram model 375RG was released in September, 1955, at £82 19s. including £23 1s. 2d. tax.

Manufactured by Ferguson Radio Corporation Ltd., Great Cambridge Road, Enfield, Middlesex.

All four receivers employ the same chassis, the table model 372A having a 6½in. PM speaker. and bureau and console radiograms an 8in. PM speaker. Models 373RG and 374RG incorporate the Collaro RC54 auto-changer, while 375RG is fitted with the Garrard RC80M.

CIRCUIT

The AM circuit is a conventional superhet employing an ECH81 frequency-changer V2, an EF89 IF amplifier V3, an EABC80 signal rectifier, AVC, and AF amplifier V4, and an EL84 output amplifier V5.

The FM circuit uses an ECF82 as RF amplifier V1A and self-oscillating mixer V1B. The pentode section of V2 becomes first IF amplifier and V3 second IF amplifier.

The ratio detector employs two of the diode anodes of V4, the rectified audio signal being fed, as in the case of the AM circuit, to triode AF amplifier section V4, and thence to output amplifier V5.

HT is provided by an indirectly-heated fullwave rectifier V6.

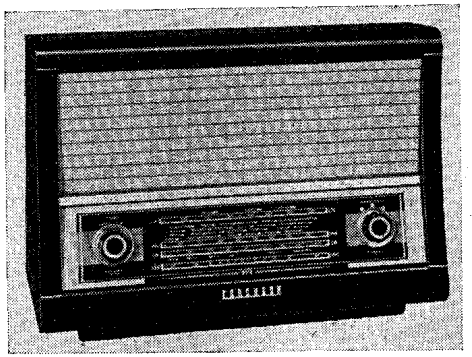
FM intermediate frequency is 10.7mc/s, and AM 470kc/s. Waveband coverage: LW 733-2050m, MW 184-575m, SW 15.7-55.4m, VHF/FM 87-99mc/s.

FM OPERATION

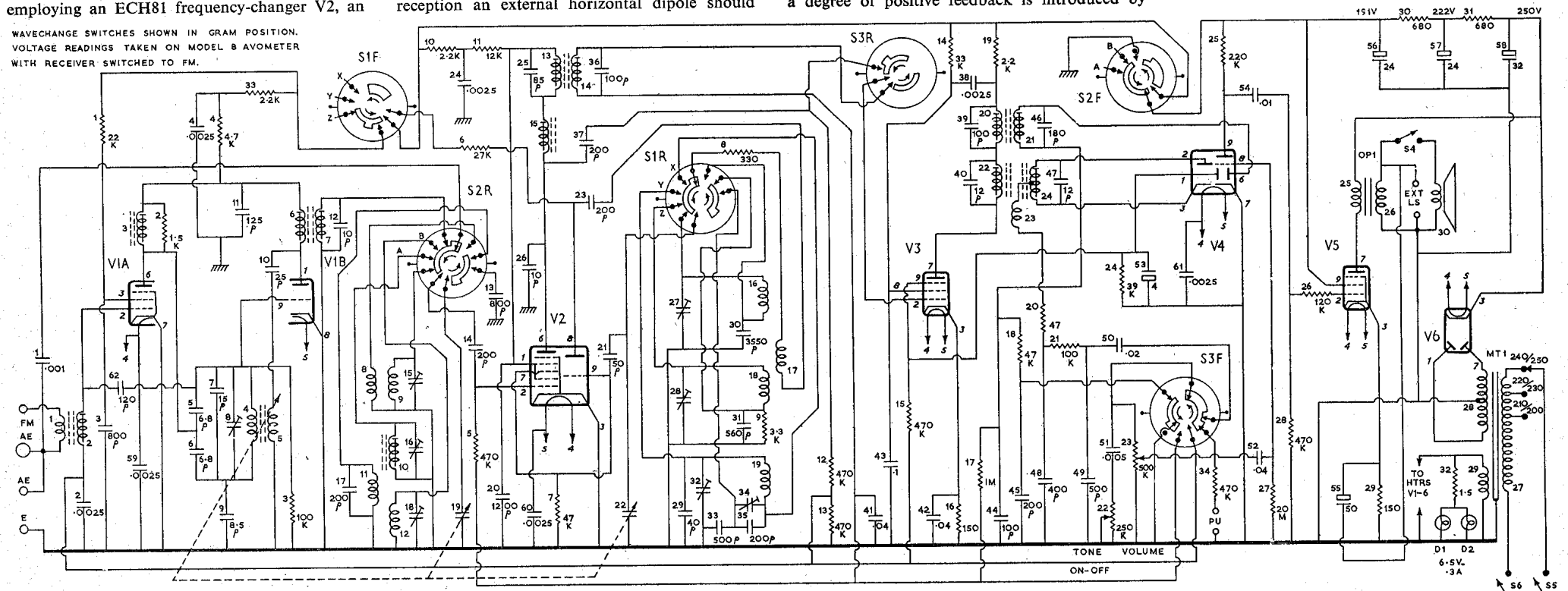
Aerial. For good signal strength areas an internal condensed dipole is provided and should be plugged into FM aerial sockets. For best reception an external horizontal dipole should be used. Input is for 75 ohm twin or coaxial feeder. When coaxial feeder is used the outer screening should be connected to the larger pin.

Aerial signal is transformer coupled by L1/2 to input grid of pentode RF amplifier V1A. L1/2 is broadly tuned by input capacitance of V1A, the overall input response curve being sufficiently wide to cover frequency range of 87-99mc/s. Signal developed across L3 in anode V1A, is injected into oscillator grid circuit V1B by capacitive potentiometer formed by C5 C6 across grid coil L4. This method of injection reduces oscillator feedback into the RF stage, since junction C5 C6 is the null point of bridge formed by C5 C6 C9 and the grid-cathode capacitance V1B.

V1B is employed as a self-oscillating mixer with permeability-tuned grid coil L4 and inductively-coupled reaction coil L5. Core L4 is mechanically linked with AM tuning drive. To counteract the effect of negative feedback caused by the grid to anode capacitance of V1B, a degree of positive feedback is introduced by



WAVECHANGE SWITCHES SHOWN IN GRAM POSITION.
VOLTAGE READINGS TAKEN ON MODEL 8 AVOMETER WITH RECEIVER SWITCHED TO FM.



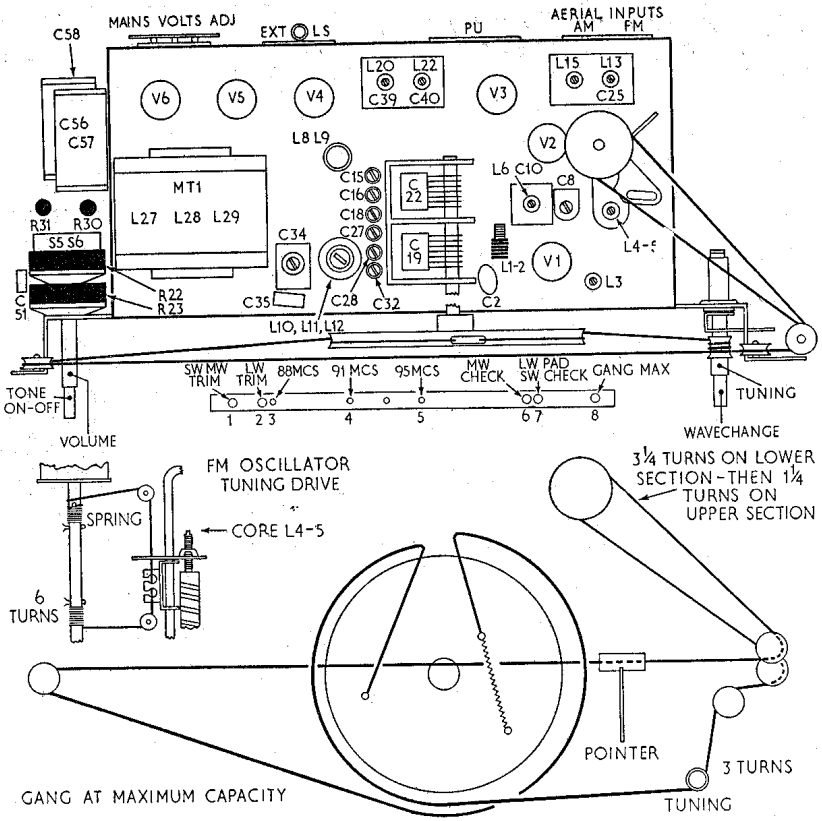
	ECF82		ECH81		EF89	EABC80	EL84	EZ80
A	122V 8·8mA	97V 10mA	65V 5·5mA	77V 3·8mA	178V 7mA	72·5V ·5mA	243V 34mA	245V RMS
G2	120V 3·5mA	—	65V 4mA	—	112V 2·4mA	—	191V 4mA	EACH ANODE
K	0V	—	0V		1·5V	0V	5·6V	250V 76mA

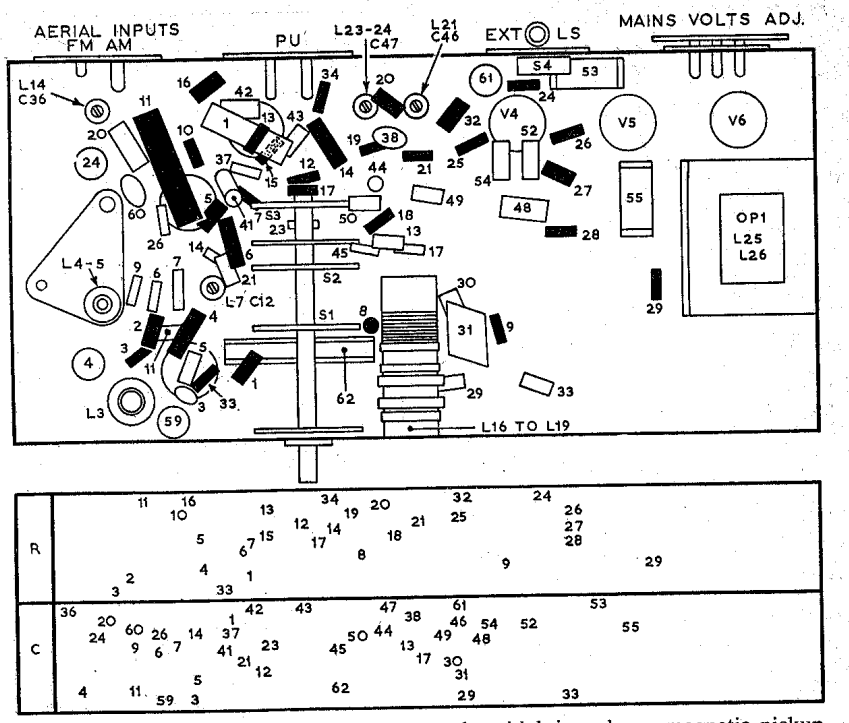
COMPONENT RATINGS

Resistors
2 watt —R11
1 watt—R30 31
½ watt—R4 6 14 32
Remainder ¼ or ⅛ watt
Potentiometers
Twin type with concentric spindles and DP switch—R22 23
Capacitors
Ceramic disc—C2 3 4 24 38 59 60 61
Tubular ceramic—C5 6 9 26
Silver mica—C31
Miniature tubular—C7 10-14 17 20 21 23 29 30 33 35 36 37 39 40 44-49
Moulded tubular—C41 42 43 50 51 52 54
Tubular 1000V—C1
Electrolytic 12V—C55
Electrolytic 100V—C53
Electrolytic 350V—C56 57 58
Preset trimmers—C8 15 16 18 27 28 32 34
C62 is formed with length 300 ohm feeder. Reservoir smoothing capacitor C58 is rated to handle 125m A ripple current.

Inductors

	L	*Ohms*
1-5, 9 15 16 22 23 24 26 29	...	Very low
6	...	.75
7	...	.75
8	...	2.3
10	...	2.6
11	...	28
12	...	30
13	...	10
14	...	10
17	...	1
18	...	2.5
19	...	15
20	...	10
21	...	7
25	...	430
27	...	30 Total
28	...	430 Total
30	...	2.75





common HT feed to anodes V1A V1B.

Anode load V1B consists of IF coupling transformer L6 L7 tuned to 10.7mc/s and R4 which is also common to V1A. HT feed is RF decoupled by C11 the value of which is such that it presents a relatively high impedance to the lower frequency of 10.7mc/s. An out-of-phase voltage at the IF frequency is therefore developed across R4 and fed through L3 to grid V1B. Capacitance existing between anode V1B and grid V1A is neutralised by C62.

IF signal at anode V1B, developed on L6 L7, is switched by S2R through C14 to grid of pentode section V2. Triode oscillator section V2 is inoperative, its HT being disconnected by S1F, and the pentode section is employed as a first IF amplifier. Signal at its anode is developed across L15 and fed by C37 through S1R to grid second IF amplifier V3.

Amplified signal at anode V3 is finally transformer coupled by L22 L23-24 to ratio detector circuit. This is of conventional design using two diodes of V4.

Apart from limiting action of the detector stage, limiting also takes place in grid circuit of IF amplifier V3 on signals strong enough to drive the valve into grid current. The negative voltage developed across R12 R13 by grid current biases back V3. In addition half this voltage, decoupled by C2, is fed to the AVC line to grid of RF amplifier V1A to prevent overloading of self-oscillating mixer V1B.

The AF signal is developed on C48 and fed through IF filter and de-emphasis circuit R21 C49, and thence coupled by C50 through S3F to Volume control R23.

Voltage across stabilising capacitor C53 is applied as a control bias to suppressor grid V3 and is then fed through R15 to AVC line controlling V1A. The AVC line is short circuited to chassis by S3F when receiver is switched to AM wavebands.

AM OPERATION

When receiver is switched to AM wavebands S1F disconnects HT feed to V1A V1B and connects HT through to triode oscillator section V2, while S2R switches the AM aerial input signal via C1 through to aerial coupling coils L8 (SW) or L11 (MW and LW).

S2R also disconnects mixer grid V2 from secondary L7 of first FM IF transformer and switches it through to grid coils L9 (SW) L10 (MW) L12 (LW) and to aerial tuning capacitor C19.

Oscillator grid coils L16 (SW) L18 (MW) L19 (LW) which are tuned by C22, and anode reaction circuits, are switched by S1R through coupling capacitors C21 C23 to oscillator grid and anode V2 respectively. Grid of first AM IF amplifier V3 is switched by S3R from C37 to secondary L14 of first AM IF transformer, tuned to 470kc/s, in anode of mixer section V2.

Signal at anode V3 is transformer coupled by L20 L21, tuned to 470kc/s, to one of diodes of V4. Volume control R23 is disconnected by S3F from FM ratio detector circuit and switched through IF filter R18 C44 C45 to bottom of L21 to function as diode load. DC component of rectified signal is decoupled by R17 C41 and fed to grids V2 V3 as AVC voltage. The AVC line is shorted down to chassis by S3F when receiver is switched to FM.

AF amplifier and output stages. Signal from volume control R23 is coupled by C52 to grid of triode AF amplifier section of V4. Automatic bias for grid is developed on C52 with R27 as leak resistor. Amplified signal at anode V4 is fed by C54 to grid of pentode output amplifier V5, the output of which is transformer coupled by OP1 to either a 6½in. or 8in. PM speaker L30.

Negative feedback, from secondary L26 of OP1, is fed back through C55 to cathode V5.

External LS sockets are provided for connection of a low impedance (3 ohms) external speaker. S4, which is operated by external speaker connecting plug, enables the internal speaker to be switched off when desired.

Tone control. R22 C51 connected across the volume control give variable top cut.

Pickup. Sockets are provided for connection of a crystal or high-impedance magnetic pickup. Signal from pickup is fed through compensating resistor R34 to S3F which in its Gram. position switches it through to Volume and Tone Control network.

HT is provided by indirectly heated fullwave rectifier V6, its anode voltages being obtained from HT secondary L28 of mains input transformer MT1. HT current for anode of output amplifier V5 is drawn direct from reservoir smoothing capacitor C58. HT for screen V5 and remainder of receiver is resistance - capacity smoothed by R30 R31 C56 C57. When waveband switch is placed in Gram. setting then HT line to V1 to V3 is disconnected by S2F thus preventing radio breakthrough on to record reproduction.

Heaters V1 to V6 are connected in parallel and fed from secondary L29 of MT1, one side of which is earthed to chassis.

Dial Lamps are connected in parallel and obtain their current from L29 through dropper R32.

Primary L27 of MT1 is tapped for 200-210, 220-230, 240-250 volts 40-60c/s AC. On-off switches S5 S6 are ganged to Tone control.

MODIFICATIONS

In a few early receivers V1 was a PCF80 instead of ECF82 as currently used. These receivers differed as follows:

1.—Heater secondary L29 of MT1 provided with overwind to supply the 9V required.

2.—Screen resistor R1 of V1 connected to junction R33 C4.

3.—Additional 4.7k ½W resistor between R4 and junction R33 C4.

4.—FM aerial coupling transformer L1-2 had different electrical characteristics.

Radiogram models 373RG 374RG 375RG have a slightly different smoothing circuit employing a speaker output transformer with a tapped primary. In these models the HT line is taken from reservoir smoothing capacitor C58 and fed to tap on primary of OP1, the top of primary being connected through R31 to junction R30 C57. Also in these models the Tone on-off and Volume are separate controls instead of twin concentric type.

ALIGNMENT INSTRUCTIONS

Remove chassis from cabinet. With the exception of model 372A, the scale, marked with RF alignment frequencies, is attached to the chassis. On model 372A the scale remains in the cabinet when the chassis is removed but marker holes are provided in the scale backing plate. The pointer is correctly positioned when it is centred in marker holes. These are identified on top layout diagram.

AM Circuits

Connect suitable output meter across external speaker sockets. Turn volume to maximum and Tone control fully anti-clockwise.

IF stages. Place gang at minimum capacity, switch to MW band. Inject 470kc/s to gl of V2 and adjust cores L21 L20 L14 L13 in that order for maximum output, progressively reducing the input as each circuit is brought into resonance.

RF stages. Connect signal generator to AM aerial input and check to see that with gang at maximum setting the dial pointer registers correctly against calibration point 8.

1.—Inject 350kc/s, tune receiver to LW, trim (2). Adjust C32 C18 for maximum output.

2.—Inject 160kc/s, tune receiver to LW, pad (7). Adjust C34 for maximum output. Repeat operations 1 and 2.

3.—Inject 1.5mc/s, tune receiver to MW, trim (1). Adjust C28 C16 for maximum output.

4.—Inject 580kc/s, tune receiver for maximum output. Check that dial pointer coincides with MW Check (6).

5.—Inject 17mc/s, tune receiver to SW, trim (1). Adjust C27 for maximum output, and then while rocking the gang adjust C15 for maximum.

6.—Inject 6mc/s, tune receiver for maximum output. Check that dial pointer coincides with SW. Check (7).

FM-Method A (Using AM-FM signal-generator.)

Apparatus required: AM-FM signal generator covering 10.7mc/s, 88-95mc/s and with at least 25kc/s deviation. Output meter connected across external speaker sockets with internal speaker switched out of circuit. High resistance voltmeter, such as Avo Model 8 on 10 volt range, connected across C53, positive to chassis.

Switch receiver to FM band, turn Volume control to maximum and Tone control fully anti-clockwise.

IF stages

1.—Inject 10.7mc/s 25kc/s deviation to grid V3 via .01 capacitor. With 30mV input adjust L22 L23-24 for maximum reading on output meter. Adjust signal-generator output to give a reading of 1.7V across C53. Re-adjust L22 L23-24 for maximum reading on output meter. Disconnect voltmeter from C53.

2.—Inject 10.7mc/s 25kc/s deviation to heptode grid V2 via .01 capacitor. Adjust L15 for maximum reading on output meter, reducing input so that AF output does not exceed 50mW.

3.—Inject 10.7mc/s 25kc/s deviation to grid V1A via .01 capacitor. Adjust L7 for maximum output. Re-adjust L15 for maximum output and then repeat both adjustments until no further improvement is obtained. Adjust L6 for maximum output. As each circuit is aligned reduce signal to prevent AF output exceeding 50mW.

Switch signal generator to 30 per cent amplitude modulation and without altering input signal level, swing frequency of generator above and below 10.7mc/s and check that the output falls to less than 0.2mW at the bottom of trough, and that trough occurs within plus or minus 50kc/s of 10.7mc/s.

RF stage. As each circuit is aligned, reduce signal to prevent AF output exceeding 50mW.

1.—Inject 88mc/s 25kc/s deviation into FM aerial input sockets. Screening of signal generator output lead must be connected to large pin and AM aerial and earth sockets should be short circuited. Check that with gang at maximum the dial pointer registers correctly against calibration point 8. Adjust C8 for maximum output.

2.—Inject 95mc/s 25kc/s deviation as above, tune receiver for maximum output, and check that pointer coincides, within plus or minus 0.5mc/s (approximately $\frac{3}{16}$in. on either side) with check point 5. If calibration is incorrect then adjust L4 to correct.

3.—Repeat operation 1 and 2 until no further improvement is obtained.

4.—Inject 91mc/s 25kc/s deviation as above. Adjust L2 L3 for maximum output.

FM-Method B (Using AM signal generator.)

Apparatus required: AM signal generator covering 10.7mc/s, 88-95mc/s. Output meter connected across external speaker sockets with internal speaker switched out of circuit. High resistance voltmeter, connected across C53, positive to chassis.

Switch receiver to FM band, turn twin Volume control to maximum and Tone control fully anti-clockwise.

IF stages. As each circuit is aligned reduce input signal so that voltage across C53 does not exceed 2V.

1.—Inject 10.7mc/s CW to grid V3 via .01 capacitor. Unscrew core L24 to its fullest extent and adjust L22 for maximum reading on voltmeter.

2.—Inject 10.7mc/s CW to heptode grid V2 via .01 capacitor. Adjust L15 for maximum reading on voltmeter.

3.—Inject 10.7mc/s CW to grid V1A via .01 capacitor. Adjust L7 for maximum voltage. Re-adjust L15 for maximum and then repeat both adjustments until no further improvement is obtained. Finally adjust L6 for maximum.

RF stage. Use procedure given in method A but with CW input and voltmeter connected across C53 as the output indicator. Keep input signal low so that output does not exceed 2V.

Ratio detector. Inject 91mc/s to FM aerial input sockets. Tune receiver and adjust signal generator output to give 2.2V across C53. Switch signal generator to AM modulation and adjust L24 for minimum audio output on output meter across secondary OP1.

Two minimum points will be obtained as core is screwed inwards. The second one, giving the lowest reading, is correct tuning point. For satisfactory AM rejection the output reading should be less than 0.2mW.

MARCONIPHONE VT64DA, VT65DA

Continued from page 8.

CIRCUIT DIFFERENCES

Circuit and layout diagrams are those of model VT64DA. Model VT65DA differs as follows:

1. HT feed to MR5 (top R50), anode V8A (top R53), and screen V8B are obtained from HT line through an 8.2K resistor decoupled by a 16mF electrolytic capacitor. These components, numbered R102 C104, are shown dotted on underside layout.

2. A 100 ohm centre-tapped horizontal shift potentiometer (VR11 on layout diagram) replaces R121 between line linearity control inductances L29 L30. Junction L43 of LT2 and width inductance L35 disconnected from junction L29 R121 and taken to slider VR11. Line deflector coil lead disconnected from junction of other end of R121 and R91 L30 and taken to centre tap of VR11.

3. A 10 ohm centre tapped vertical shift potentiometer (VR10 on layout diagram) is incorporated. HT line is disconnected from end F1 and taken to slider VR10, and F1 is connected to its centre tap. Top secondary L51 of FT2 is disconnected from HT and taken to one end VR10. Top of frame deflector coil L32, R96 C89 are also disconnected from HT and taken to the other end of VR10.

MODIFICATIONS

Value of capacitor C88 is decided on test of each receiver and varies between 30-60pF.

Earlier models differed from the circuit as follows:

A 1pF capacitor connected between anode V2 and grid V3, and anode V3 and grid V4.

C3 changed to 30pF, C4 to 22pF, and C5 to 27pF. L14 shunted by 22K resistor and 2pF capacitor.

L22 C37 disconnected from anode V12A and connected down to chassis. C36 disconnected from anode V4 and connected to anode V12A. Value C36 changed to 1.5 pF, C37 to 2pF. A 1.4 pF capacitor between anode V4 and anode V12A. L34 shunted by 22K resistor, C40 changed to 15pF, R118 changed to 15K, R81 to 1.5M, and R103 C102, R106 C99, and R104 R105 deleted.

Sequence of heater connections differed slightly. On chassis layout C44 may be found adjacent to VR9. C81 removed from between L44 L45 of LT2, which are then connected together. Connection between L43 L35 and junction L29 C85 R121 removed and C81 connected in its place. R121 deleted and ends L29 L30 connected together. Deflector coil lead removed from L30 to other side of C81.

REMOVAL OF CHASSIS

It is advisable to remove speaker before attempting to remove chassis. Speaker leads are connected to tag panel of speaker by press-studs.

Slacken wing nut on top of side control panel bracket and move control panel inwards over chassis so that its knobs are well clear of side of cabinet. Unsolder cabinet screening lead from tag below aerial panel. Pull off the front control knobs. Remove the four insulating caps covering heads of chassis bolts which can then be unscrewed. Withdraw chassis.

Anti-dust ring. Before replacing chassis remember to place rubber dust ring around the edge of CRT screen. When chassis is secured in position the ring can be pushed over edge of CRT to seal gap between tube and mask.

Removal of CRT. Unplug base connector, slacken ion trap-clamp screw and slide off ion trap magnet. Earth anode of CRT to chassis and unplug EHT lead. Unplug leads from sockets on deflector coil panel. Slacken screw fastening clamp band around front of CRT. The CRT complete with deflector coils can now be carefully removed from receiver chassis.

ALIGNMENT

Apparatus required. Signal-generator covering 34–39mc/s, 41–57mc/s and 176–215mc/s, with 400c/s 30 per cent. modulation; a 0–10V AC voltmeter, and a 0–200 microammeter.

Connect the AC voltmeter across speaker speech coil, and the microammeter between chassis (negative) and Test Point 2 (positive).

Input signal for vision alignment is unmodulated. Sound alignment requires 400c/s audio modulation.

IF stages. Place volume and contrast at maximum, brilliance and noise suppressor at minimum. Set the channel selector to roughly mid-position of Band 3 (channel 9). Connect signal-generator output lead to Test Point 1.

1. Inject 37.5mc/s—tune L24 L25 L26 L27 L28 for maximum sound, and L22 for minimum vision.
2. Inject 38.5mc/s—tune L18 for minimum vision.
3. Inject 34.25mc/s—tune L14 L17 L21 (bottom cores) for maximum vision.
4. Inject 36.25mc/s—tune L12–13 L15–16 L19–20 (top cores) for maximum vision.
5. Repeat operations 3 and 4 until a symmetrical response curve is obtained with equal peaks at 34.24mc/s and 36mc/s.
6. Check tuning of L22 at 37.5mc/s, and L18 at 38.5mc/s, for minimum vision.

RF STAGES

Band 1. Place channel selector knob fully clockwise. Place volume contrast, RF gain at maximum, and brilliance, noise suppressor to minimum.

Slacken Band 1 tuner locking screw and rotate tuning spindle so that flat portions of cams are parallel with top of chassis when the ganging plate is in its uppermost position. Tighten tuner locking screw.

1. Inject 41.5mc/s into Band 1 aerial socket—tune L11 for maximum sound.
2. Inject 53.25mc/s—slacken tuner locking screw and using tuning spindle tune for maximum sound. Tighten locking screw.
3. Inject 56.5mc/s—tune L7 for maximum vision.
4. Turn RF gain to minimum. Inject 55mc/s—tune L4 for maximum vision.
5. Repeat operations 3 and 4.

IF FILTER COILS

Inject 34mc/s to Band 1 aerial socket—tune L1 for minimum vision. Inject 38mc/s—tune L2 for minimum vision. Inject 36mc/s—tune L3 for minimum vision.

Band 3. Set the channel selector knob to channel 10.

1. Inject 196.25mc/s into Band 3 aerial socket—tune L10 for maximum sound.
2. Inject 176.25mc/s—rotate the channel selector knob for maximum sound. This should be when the pointer nears its fully anti-clockwise position—channel 6.
3. Inject 211.25mc/s—rotate channel selector knob for maximum sound. This should occur when pointer indicates channel 13.
4. If in operations 2 and 3 the pointer indicates plus or minus half a channel position, slightly open up the oscillator coil L10 if tracking is cramped, or compress if tracking is too extended. After each adjustment it is necessary to repeat operation 1 before checking operations 2 and 3.
5. Inject 211.25mc/s—rotate channel selector knob for maximum sound.
6. Inject 214.75mc/s—tune L9 L8 L5 for maximum vision.
7. Check gain and tracking over Band 3 and ensure that no channel is more than 6dB down in gain on the best channel, except channel 13.

NOTE.—Where gain or tracking appears grossly out at any point, some improvement may be obtained by slightly re-tuning L8 at this particular point.