BUSH RADIO

Service Instructions

MODEL VHF.90

FOR AC/DC MAINS

INDEX

SPECIFICATION

Circuit Outline

With the waveband switch in the M.W. position, the circuit is a conventional 6-valve (including rectifier) superhet employing Mullard valves as follows:—

Mixer UCH81 (V2)
1st I.F. Amplifier UF89 (V3)
2nd I.F. Amplifier UF89 (V4)
AGC Diode and Audio Amplifier UABC80 (V5)
Output UL84 (V6)
Half-wave Rectifier UY85 (V7).

In the V.H.F. position, however, two additional stages are brought into operation and the sequence becomes:—

Grounded-grid input Amplifier 1/2 UCC85 (V1A)
Oscillator/Mixer 1/2 UCC85 (V1B)
1st I.F. Amplifier-Heptode of UCH81 (V2)
2nd I.F. Amplifier UF89 (V3)
3rd I.F. Amplifier UF89 (V4)
Ratio Detector and Audio Amplifier—two diodes and triode of UABC80 (V5)
Output UL84 (V6)
Half-wave Rectifier UY85 (V7).

V.H.F. Oscillator and R.F. tuning is by means of iron-dust cores moved by a cord drive system attached to the spindle of the M.W. tuning capacitor.

On V.H.F. the I.F. is changed from 470 kc/s to 10·7 mc/s and selection of the appropriate set of I.F. transformers is achieved by the waveband slider switch.

Valves

Mullard	Heater
UCC85 (V1A, V1B)	26V. 0·1A
UCH81 (V2)	19V. 0·1A
UF89 (V3, V4)	12·6V. 0·1A
UABC80 (V5)	28V. 0·1A
UL84 (V6)	45V. 0·1A
UY85 (V7)	38V. 0·1A

All bases B9A

Voltage Range

200 to 250V. AC. or DC.

Mains Consumption

45 watts approx.

Scale Lamps

2 at 3·5V. 0·15A.

Audio Output

2 watts approx.

Wavebands

M.W.—524 to 1,600 kc/s (572·5 to 187·5 metres).
V.H.F.—87·5 to 100 mc/s (3·4 to 3 metres).

Intermediate Frequencies

M.W.—470 kc/s.
V.H.F.—10·7 mc/s.

Aerials

M.W.—An internal ferrite rod is incorporated which is permanently connected.

V.H.F.—A shortened dipole is fitted to the cabinet back. This is connected to the receiver by means of an 80-ohm line and 2-pin plug.

An external aerial may be employed, if necessary.

Cabinet Dimensions

Height—9·5 in.
Depth—7 in.
Width—12·5 in.

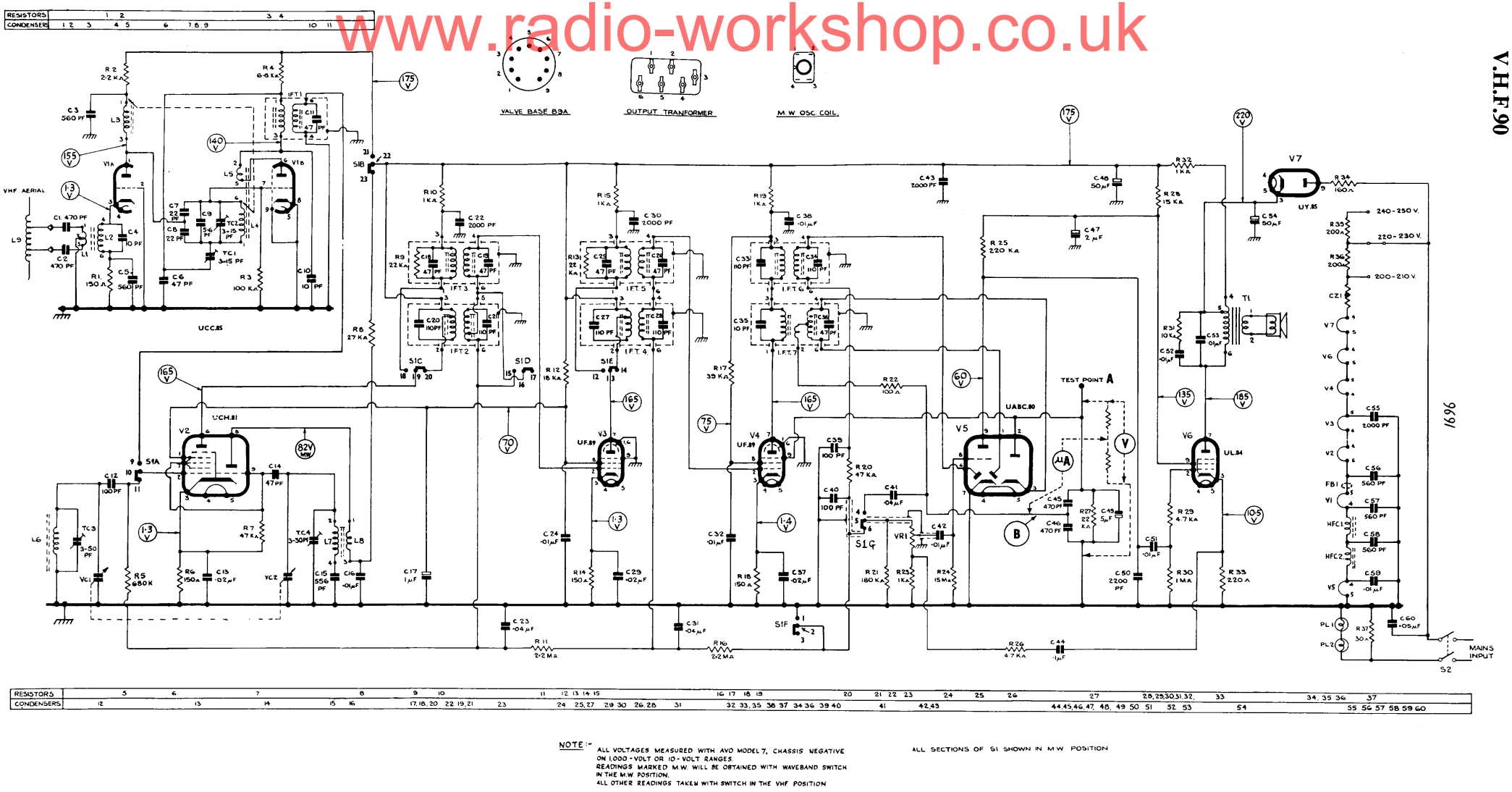

Fig. 1—Circuit Diagram. *See Figs. 2 and 6 for number references to coils and switches.*

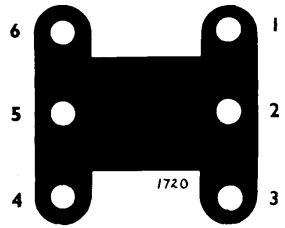

Fig.3—Key to I.F.T. bases in Fig.2

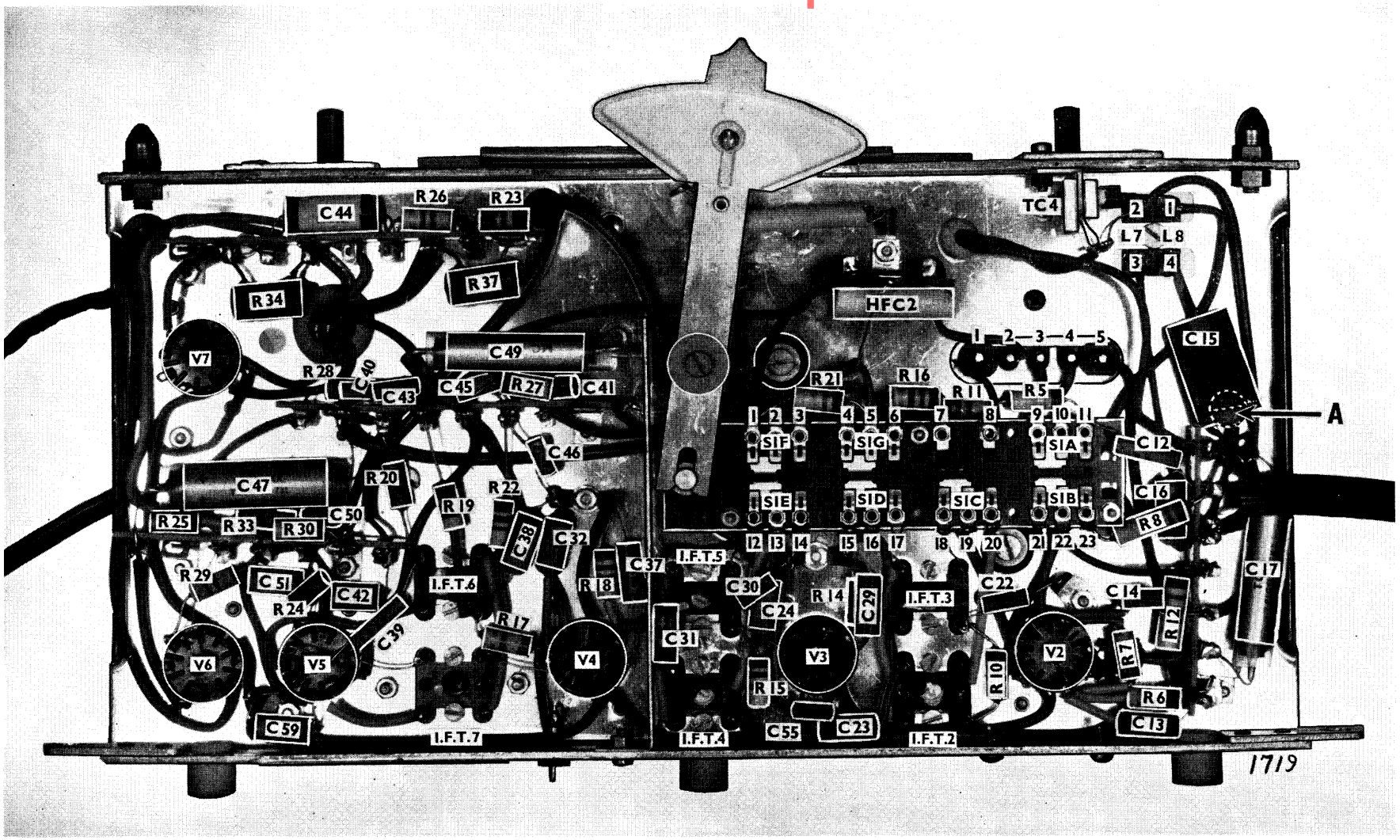

Fig. 2—Under View of Chassis. See Fig. 1 for number references

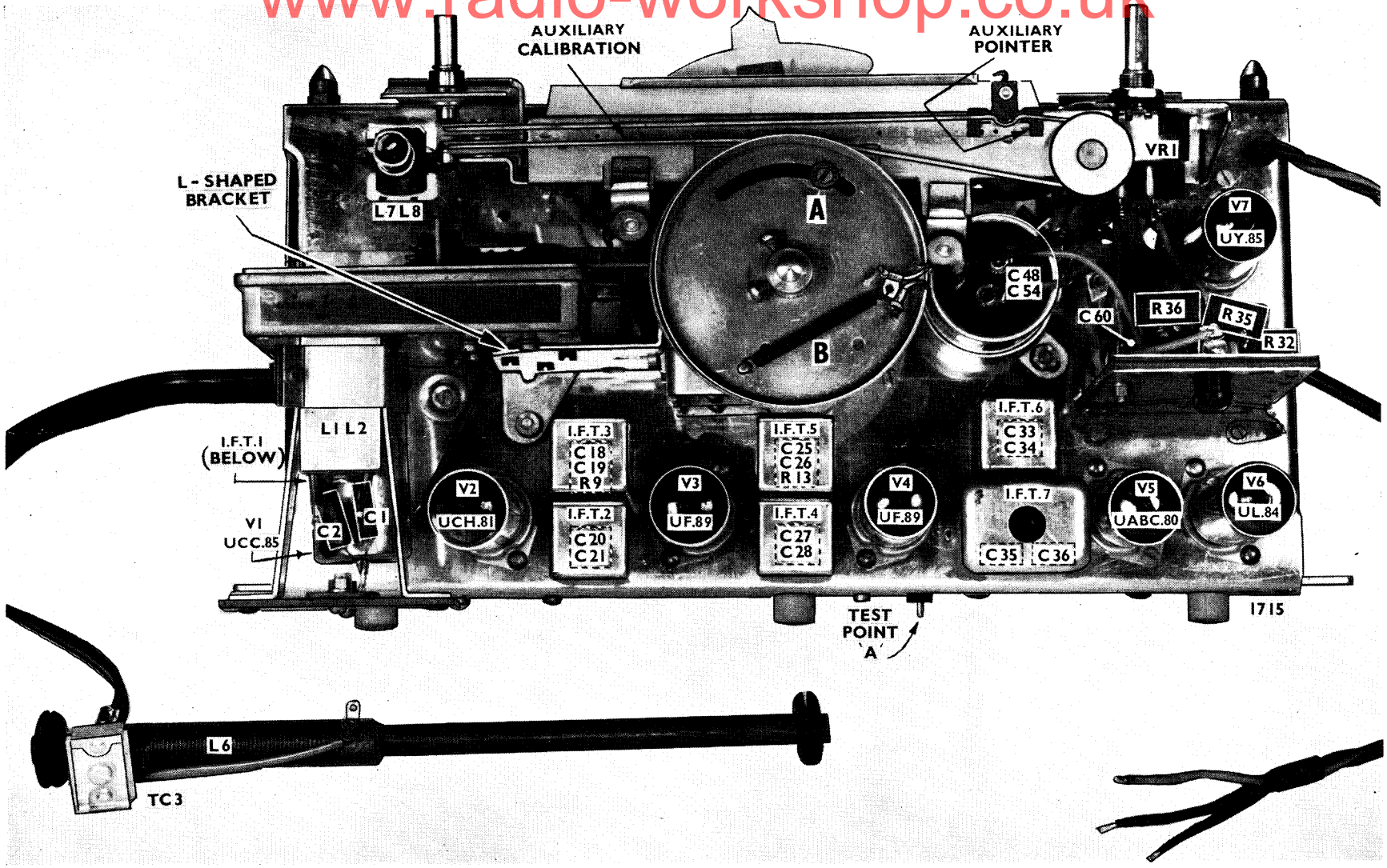

Fig. 4—Top View of Chassis

ALIGNMENT PROCEDURE (GENERAL)

(*a*) Remove receiver from cabinet.
(*b*) The receiver and signal generator should be switched on 15 minutes before alignment is attempted.
(*c*) It will be seen that an auxiliary scale has been provided on top of the scale reflector plate. This scale consists of a number of indents which are referred to in a calibration label (Fig. 5) affixed to the top of the V.H.F. sub-chassis. Part of the pointer carriage is used as an auxiliary pointer in relation to the indents (Fig. 4). With the tuning capacitor at maximum, the auxiliary pointer should coincide with the datum indent.
(*d*) Use a non-metallic trimming tool.
(*e*) IFT7 has the secondary at the bottom of its can: all other I.F.T.'s have secondaries at the top.

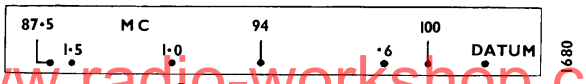

Fig. 5—Calibration Label

ALIGNMENT PROCEDURE (M.W.)

I.F. Alignment (470 kc/s)
(*a*) Switch receiver to M.W. and set auxiliary pointer to 1 mc/s. Inject 470 kc/s modulated to pin 2, V4 and adjust Sec. and Pri. IFT6 for maximum audio output. Transfer generator to pin 2, V3 and adjust Sec. and Pri. IFT4 for max. output. Transfer generator to pin 2, V2 and adjust Sec. and Pri. IFT2 for max. output.

R.F. Alignment
With generator still connected to pin 2, V2, align as follows:—

Operation	Generator (mc/s)	Receiver Calibration Mark	Adjust for Maximum
1	600 kc/s	·6	L7/8 Osc.
2	1,500 kc/s	1·5	TC4 Osc.
3	Repeat and check calibration		

For the adjustment of TC3 (trimmer on ferrite rod aerial) it is necessary to couple the generator by means of a single-turn loop of wire approximately 5 in. in diameter, positioned 12 in. to 18 in. away from the cabinet.

Set generator and auxiliary pointer to 1,500 kc/s and adjust TC3 for maximum output.

Note.—The M.W. aerial coil L6, which is part of the ferrite rod assembly, has been preset at the factory and no readjustment should normally be necessary.

If, however, a new rod has been fitted realign as follows:—

Set generator and auxiliary pointer to 600 kc/s. Couple generator by single-turn loop as before.

Gently slide the aerial coil former to and fro on the rod until the maximum output point is reached. Seal in position with wax.

ALIGNMENT PROCEDURE (V.H.F.)

Test Equipment Required
(1) Signal Generator for 10·7 mc/s (I.F.) and 87·5 to 100 mc/s.
(2) AVOmeter Model 8, *or*
(2) D.C. Valve-Voltmeter and Microammeter (50 μA F.S.D.).
(3) 2 47K 1/4-watt resistors, matched.
(4) 1 1K 1/4-watt resistor.

I.F. Alignment (10·7 mc/s)
Switch receiver to V.H.F. band. Connect the two 47K resistors, in series, between the test point 'A' and chassis. Connect the A.V.O. model 8 (on 10V. D.C. range) or the valve-voltmeter across the two resistors. These components are shown dotted in the circuit diagram (Fig. 1).

Note.—With the exception of the discriminator (IFT7) primary, the correct peak associated with all cores is the first one reached:—
(a) From the top of the coil former as the core enters the secondary winding or
(b) From the base of the coil former as the core enters the primary winding.

Now proceed as follows:—
(*a*) Inject 10·7 mc/s unmodulated to pin 2, V2 and turn volume control to minimum. During alignment, it is advisable to ensure that the input from the generator is just sufficient to maintain an output of 4V. on the voltmeter.
(*b*) Adjust Pri. IFT7 for maximum D.C. output. (Start with core ¾ in. inside former.)
(*c*) Connect the 1K resistor across Sec. IFT5 and adjust Pri. IFT5 for maximum D.C. output.
(*d*) Transfer 1K resistor to Pri. IFT5 and adjust Sec. IFT5 for maximum D.C. output.
(*e*) Transfer resistor to Sec. IFT3 and adjust Pri. IFT3 for maximum D.C. output.
(*f*) Transfer resistor to Pri. IFT 3 and adjust Sec. IFT3 for maximum D.C. output. Remove resistor.
(*g*) Readjust Pri. IFT7 for maximum D.C. output.
(*h*) Connect the A.V.O. (on 50 μA range) or microammeter between the junction of the two 47K resistors and point 'B' (see Fig. 1).
(*j*) Adjust Sec. IFT7 to produce zero response on the microammeter. (Start with core ⅜ in. inside former.)

Note.—Zero response can only occur when the Sec. IFT7 is in balance. When detuned, either positive or negative output will be obtained. The A.V.O. model 8 has a reversing button to allow readings in either direction, but the connections to the microammeter (if used) will need to be changed over as necessary.

(*k*) Re-connect the voltmeter between the test point 'A' and chassis. Check Pri. IFT7 for maximum D.C. output.

Note.—It is essential that maximum D.C. output coincides with minimum response on the microammeter.

(*l*) Transfer signal input to the V.H.F. aerial sockets and adjust Pri. and Sec. IFT1 for maximum D.C. output.

R.F. Alignment
(*a*) Set generator and the auxiliary pointer to 87·5 mc/s. Slacken locking screw on the pivoted adjuster (A-Fig. 4) and rotate the arm for maximum D.C. output. This operation adjusts the cores of L3 (R.F.) and L4/L5 (Osc.). Tighten locking screw.
(*b*) Set generator and pointer to 94 mc/s and adjust L1/L2 (Aerial) for maximum D.C. output.
(*c*) Check calibration.

Note.—No reference has so far been made to the trimmers TC1 and TC2 (Fig. 6).

TC1, the oscillator bridge balancing trimmer, has been adjusted in production for minimum transmission of oscillator voltage to the V.H.F. aerial sockets.

TC2, the oscillator trimmer, has been similarly adjusted for optimum V.H.F. calibration.

As these trimmers are set up using special alignment gear and subsequent variation is unlikely, no readjustment should be necessary in future.

Replacement of V1 (UCC85) may cause slight changes in oscillator calibration. If so, the pivoted adjuster should be reset as detailed above.

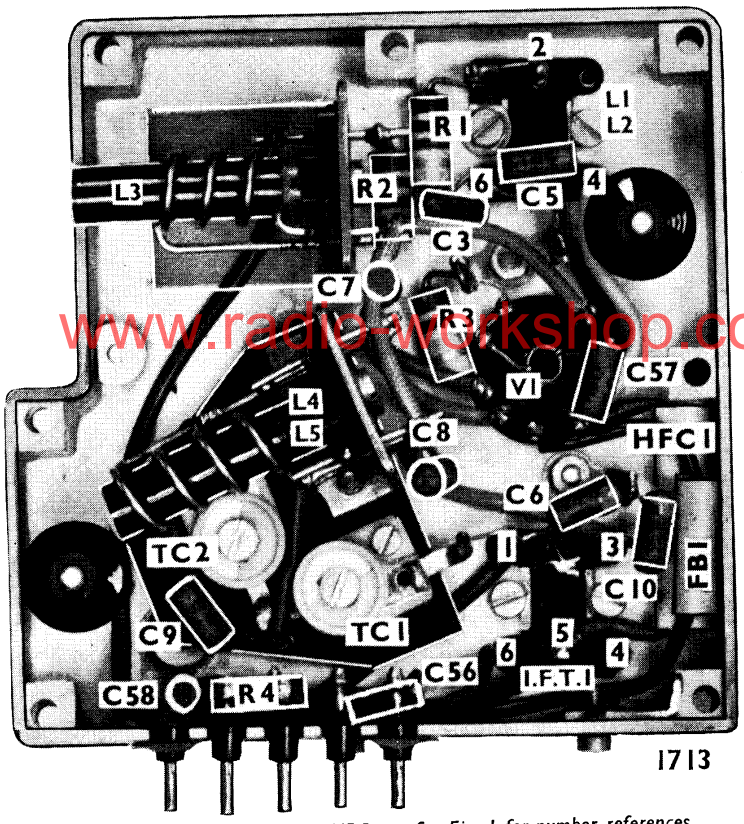

Fig. 6—Component layout—VHF Box. See Fig. 1 for number references

VALVE VOLTAGES AND CURRENTS (See Fig. 1)

Valve	Anode Volts	Screen Volts	Cathode Volts	Cathode Current (mA)
V1A (UCC85)	155	—	1·3	8·6
V1B (UCC85)	140	—	—	5
V2 (UCH81)	F.C. 165	70	1·3	8·6
	Osc. 82 (M.W.)	—		
V3 (UF89)	165	70	1·3	8·6
V4 (UF89)	165	75	1·4	9·3
V5 (UABC80)	60	—	—	0·3
V6 (UL84)	185	135	10·5	50
V7 (UY85)	—	—	220	—

The above-mentioned circuit diagram quotes the conditions under which these readings were taken. Variations may occur without impairing the performance of the receiver.

DISMANTLING

REMOVING V.H.F. BOX FROM CHASSIS

(1) Unsolder the five connections to the box (see next column).
(2) Set the tuning capacitor to minimum and unhook the spring from the drive drum.
(3) Remove the cord drive from the drive drum.
(4) Release and remove the screw and washer (A—Fig. 4) from the pivoted adjuster.
(5) Unbolt and remove the drive drum.
(6) Remove cord from around the brass boss (C—Fig. 7).
(7) Remove the three bolts holding the box to the L-shaped bracket (Fig. 4) and remove the bolt (A—Fig. 2) from beneath the chassis.

CONNECTIONS TO V.H.F. BOX (FIG. 2)

(1) S1B (tag 21).
(2) HFC2.
(3) V2 (pin 5).
(4) S1A (tag 9).
(5) Chassis.

REMOVING CHASSIS FROM CABINET

(1) Remove the two push-on control knobs.
(2) Remove the ferrite rod by gently levering the ends so that the rubber grommets clear the metal brackets.
(3) Release the two chassis fixing bolts.
Note.—The leads to the output transformer are long enough to allow the chassis to be removed.

REPLACING V.H.F. TUNING CORD DRIVE

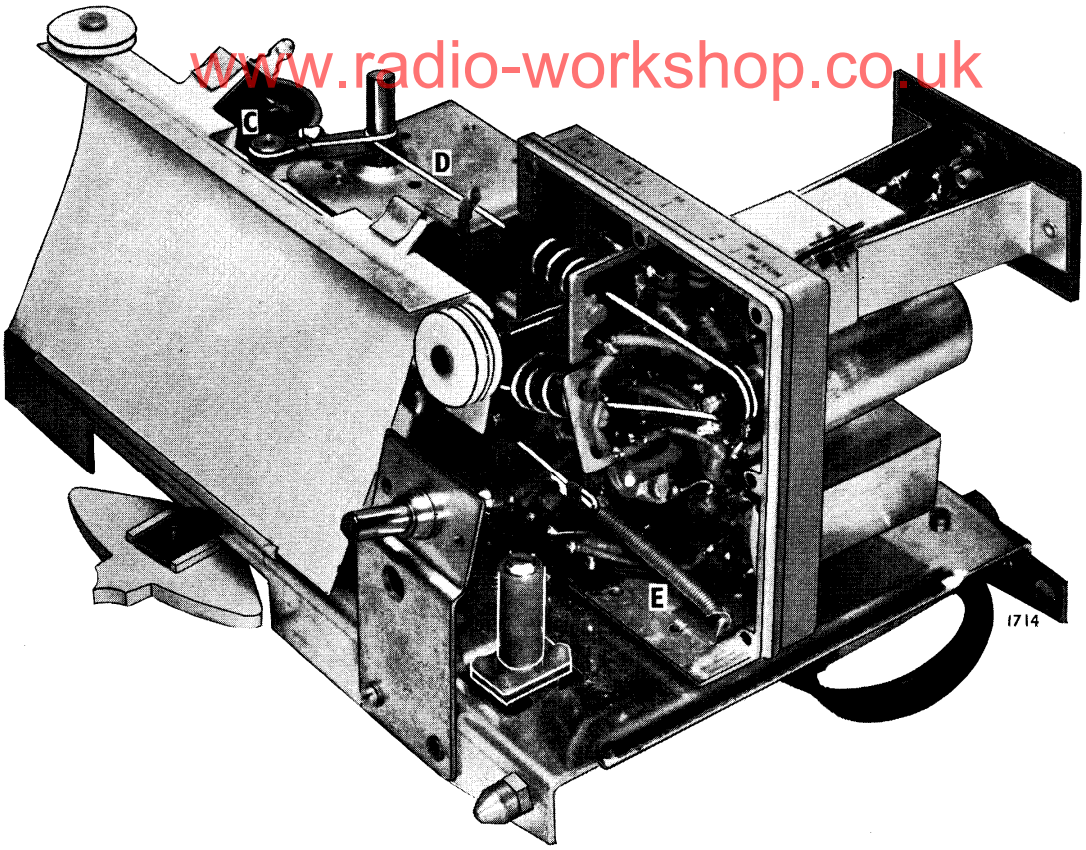

Fig. 7—VHF Cord Drive

Should a breakage occur in either cords or cores it is recommended that the complete assembly (AP24888) be obtained and fitted as follows:—

(1) Remove chassis from cabinet (see page 6).

(2) Unbolt and remove the side of the V.H.F. box nearest to the front of the chassis.

(3) Set the tuning capacitor to minimum to ease tension on the return spring (E—Fig. 7) in the V.H.F. box.

(4) Unhook spring (B—Fig. 4) from the drive drum.

(5) Remove the cord drive from the drive drum.

(6) Release and remove the screw and washer (A—Fig. 4) from the pivoted adjuster.

(7) Unbolt and remove the drive drum.

(8) Thread assembly of tuning cores (D—Fig. 7) through coil formers and hook the spring (E—Fig. 7) to its anchorage.

(9) Now take one turn in a clockwise direction around the tuning capacitor spindle and slip the loop in the cord over the brass boss (C—Fig. 7).

(10) After reassembly, check that the auxiliary pointer coincides with the datum indent when the tuning capacitor is at maximum capacity.

(11) Reset pivoted adjuster as laid down in the Alignment Procedure (V.H.F.).

PART NUMBERS

Assembly of Tuning Cores	AP24888
Pulley (black)	AP24684
Spring, cord tension	AP24740

MISCELLANEOUS PART NUMBERS

Description	*Part No.*
Aerial, ferrite	CS24887
Assembly of back, cabinet	DS24895
Assembly of knob, control (less clip)	AS24920
Clip, knob (1 per knob)	AP16423
Core, ferroxcube (FB1)	AP22966
Pilot lamp (3·5V. 0·15A.)	AP16631
Plug, 2-pin	AP20161

Description	*Part No.*
Rod, ferrite	AP24619
Scale, tuning	DP24753
Slider switch, 8-pole	AP24687
Speaker, elliptical	BP18259
Spring (switch actuator)	AP24715
Valveholder, B9A	AP22419
Valveholder, B9A (with skirt)	AP22841

REPLACING TUNING CAPACITOR CORD DRIVE

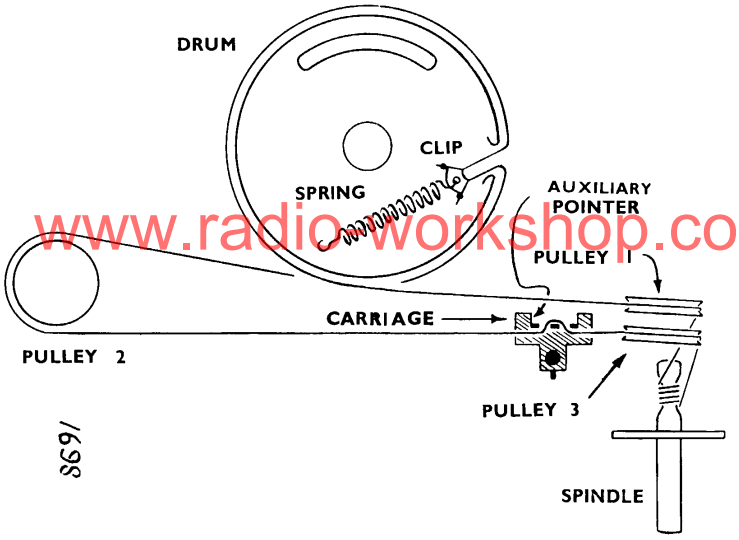

Fig. 8—Assembly of Cord Drive

The diagram, Fig. 8, shows the position of the drive drum with the tuning capacitor at maximum. The length of glass-nylon cord required is approximately 30 inches.

Hook the cord and clip to the spring and attach the other end of the spring to the drive drum. Pass the cord through the opening on the drum, round pulley 2 and then round pulley 3. Now take four turns around the spindle in a clockwise direction, round pulley 1 and finally around the drive drum in a clockwise direction.

PART NUMBERS

Carriage	AP23662
Clip, cord drive	P1940
Cord drive assembly (including clip, spring and cord)	AS24899
Drum, drive	AP24685
Pointer	AP24743
Pointer and Carriage	AS24898
Pulley (white)	AP12416
Spring, cord drive	P1941

COILS, CHOKES AND TRANSFORMERS

Reference	Resistance (Ohms)	Part Number	Description
HFC1 & 2	Less than 0·5	AS24886	Heater chokes
IFT1	Pri. Less than 0·5 Sec.— „ „ „	BS24879	V.H.F. 1st I.F.T.
IFT2	Pri.—14 Sec.—14	CS24880	M.W. 1st I.F.T.
IFT3	Pri.—Less than 0·5 Sec.— „ „ „	BS24878	V.H.F. 2nd I.F.T.
IFT4	Pri.—14 Sec.—14	CS24881	M.W. 2nd I.F.T.
IFT5	Pri.—Less than 0·5 Sec.— „ „ „	BS24878	V.H.F. 3rd I.F.T.
IFT6	Pri.—14 Sec.—14	BS24304	M.W. 3rd I.F.T.
IFT7	Pri.—Less than 0·5 Sec. 1— „ „ „ Sec. 2— „ „ „	CS24882	V.H.F. discriminator
L1	Less than 0·5	CS24884	V.H.F. aerial coils
L2	„ „ „		
L3	„ „ „	BS24885	V1A anode coil
L4	„ „ „	BS24883	V.H.F. oscillator coils
L5	„ „ „		
L6	„ „ „	CS24887 *	Ferrite rod aerial coil
L7	4	BS25791	M.W. oscillator coils
L8	1		
L9	Less than 0·5	AS24894	V.H.F. aerial loading coil
T1	Pri. 600 Sec.—Less than 0·5	AS24916	Output transformer

Iron dust cores required:—
L3, L4/5 —AP24617
HFC1 & 2—AP24621
Remainder—AP17109

* This Part Number is for the complete ferrite rod aerial assembly.

CAPACITORS

Reference	Value		Type	D.C. Working Volts	Tolerance ± %	Part No.
	µF	pF				
C1	—	470	SC	1,750	25	AP21458
C2	—	470	SC	1,750	25	AP21458
C3	—	560	SC	350	20	AP23405
C4	—	10	SM	350	5	AP18211
C5	—	560	SC	350	20	AP23405
C6	—	47	SC (N750)	750	5	AP24630
C7	—	22	SC (P100)	750	2	AP24626
C8	—	22	SC (P100)	750	2	AP24626
C9	—	5·6	SC (N750)	750	0·5 pF	AP24628
C10	—	10	SC (N750)	750	5	AP24629
C11	—	47	SM	350	5	AP24848
C12	—	100	SC	750	20	AP17336
C13	0·02	—	MP	150	20	AP22251
C14	—	47	SC	750	20	AP17338
C15	—	556	SM	350	1	AP24469
C16	0·01	—	PT	350	20	AP24117
C17	1	—	E	350	+50 −20	AP22254
C18	—	47	SM	350	5	AP24848
C19	—	47	SM	350	5	AP24848
C20	—	110	SM	350	2	AP25808
C21	—	110	SM	350	2	AP25808
C22	—	2,000	SC	350	+50 −20	AP23407
C23	0·04	—	MP	200	20	AP24028
C24	0·01	—	PT	350	20	AP24117
C25	—	47	SM	350	5	AP24848
C26	—	47	SM	350	5	AP24848
C27	—	110	SM	350	2	AP25808
C28	—	110	SM	350	2	AP25808
C29	0·02	—	MP	150	20	AP22251
C30	—	2,000	SC	350	+50 −20	AP23407
C31	0·04	—	MP	200	20	AP24028
C32	0·01	—	PT	350	20	AP24117
C33	—	110	SM	350	2	AP25808
C34	—	110	SM	350	2	AP25808
C35	—	10	SM	350	5	AP24847
C36	—	47	SM	350	5	AP24848
C37	0·02	—	MP	150	20	AP22251
C38	0·01	—	PT	350	20	AP24117
C39	—	100	SC	750	20	AP17336
C40	—	100	SC	750	20	AP17336
C41	0·04	—	MP	200	20	AP24028
C42	0·01	—	PT	350	20	AP24117
C43	—	2,000	SC	350	+50 −25	AP23407
C44	0·1	—	MP	150	25	AP21245
C45	—	470	SC	500	20	AP24631
C46	—	470	SC	500	20	AP24631
C47	2	—	E	350	+50 −20	AP24841
C48	50	—	E	275	+50 −20	AP24627
C49	5	—	E	50	+50 −20	AP22255
C50	—	2,200	SC	350	10	AP24717
C51	0·01	—	PT	350	20	AP24117
C52	0·01	—	PT	500	25	P3769
C53	0·01	—	PT	500	25	P3769
C54	50	—	E	275	+50 −20	See C48
C55	—	2,000	SC	350	+50 −25	AP23407
C56	—	560	SC	350	20	AP23405
C57	—	560	SC	350	20	AP23405
C58	—	560	SC	350	20	AP23405
C59	0·01	—	PT	350	20	AP24117
C60	0·05	—	PT	500	20	AP15077
TC1	—	3 to 15	—	—	—	AP24623
TC2	—	3 to 15	—	—	—	AP24623
TC3	—	3 to 50	—	—	—	AP24772
TC4	—	3 to 30	—	—	—	AP23949
VC1	—	528	Ganged	—	—	BP23657
VC2	—	528				

E.—Electrolytic. M.P.—Metallized Paper. P.T.—Paper Tubular. S.C.—Silver Ceramic. S.M.—Silver Mica.

RESISTORS

Reference	Value (Ohms)	Rating (Watts)	Tolerance ± %	Part No.
R1	150	1/4	10	P6155
R2	2·2K	1/4	10	P6449
R3	100K	1/4	10	P6869
R4	6·8K	1/2	10	P6574
R5	680K	1/4	20	P7073
R6	150	1/4	10	P6155
R7	47K	1/4	20	P6779
R8	27K	1/2	20	P14076
R9	22K	1/4	10	AP25342
R10	1K	1/4	20	P6359
R11	2·2M	1/4	20	P7199
R12	18K	1/2	10	P6676
R13	22K	1/4	10	AP25342
R14	150	1/4	10	P6155
R15	1K	1/4	20	P6359
R16	2·2M	1/4	10	P7205
R17	39K	1/4	10	P6761
R18	150	1/4	10	P6155
R19	1K	1/4	20	P6359
R20	47K	1/4	20	P6779
R21	180K	1/4	20	P14227
R22	100	1/4	20	P6107
R23	1K	1/4	10	P6365
R24	15M	1/4	33⅓	P14548
R25	220K	1/4	10	P6953
R26	4·7K	1/4	10	P6533
R27	22K	1/4	10	P6701
R28	15K	1/2	10	P6658
R29	4·7K	1/4	20	P6527
R30	1M	1/4	20	P7115
R31	10K	1/4	10	P6617
R32	1K	8	5	AP19726
R33	220	1/2	10	P6196
R34	160	4	5	AP18169
R35	200	4	5	AP24624
R36	200	4	5	AP24624
R37	30	4	5	AP23458
VR1	500K (semi-log)	—	—	BP24625
CZ1	Thermistor	—	—	AP16020

ERRATUM

Page 5 — I.F. ALIGNMENT (10.7 mc/s) — Delete para ' k '.

Page 7 — Amend sub-para (10) to read as follows :—
(10) Repositioning the drive drum should present no difficulty if it is noted that the gap in the edge of the drive drum (through which the drive cord passes) should be immediately above the visible part of the V.H.F. tuning cord when the ganged capacitor is at maximum capacity. Check that the auxiliary pointer coincides with the datum indent.

Page 7 — Add under MISCELLANEOUS PART NUMBERS :—
Cabinet, cream DP24474
Cabinet, brown DP25825

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