"TRADER" SERVICE SHEET

921

G.E.C. BC4940/45

A.C. and A.C./D.C. Superhets

TWO 4-valve (plus rectifier) 3-band G.E.C. superhets are covered in this *Service Sheet* : the BC4940 which is designed to operate only from A.C. mains of 200-250 V, 40-100 c/s; and the BC4945, which operates from A.C. or D.C. mains of 200-250 V, 25-100 c/s. A low-voltage version of the A.C. model, called the BC4940L, covers 115-220 V A.C. mains. The waveband ranges are 16.5-50 m, 192-550 m, and 1,000-2,000 m.

Our circuit diagram is based on the A.C. model, but except for the mains input circuit, the H.T. feed and cathode circuit, and a few minor points elsewhere, the two models are similar. The differences in the A.C./D.C. model are indicated in our circuit diagram by broken lines. Except where it is obvious that these replace solid lines in the A.C. diagram, the circuit drawn in solid lines is applicable to both models.

Elsewhere, also, our information is based on the A.C. model, but unless some remark is made as to a difference it applies equally to the A.C./D.C. model.

Release date (all models) October 1948. *Original prices: B*4940 *and BC*4940*L*, £16 16*s.*; *BC*4945, £17 6*s.* 6*d.* *Purchase tax is extra.*

CIRCUIT DESCRIPTION

Aerial input is inductively coupled by **L1** on S.W., and capacitatively "bottom" coupled by **C1** on M.W. and L.W., to single-tuned circuits **L2, C26** (S.W.), **L3, C26** (M.W.), **L3, L4, C26** (L.W.) which precede a triode hexode valve **(V1, Osram metallized X61M)** operating as frequency changer with internal coupling. In the A.C./D.C. version isolating capacitors **C35, C36,** and an R.F. choke **L14** are included in the aerial coupling circuit.

Triode oscillator grid coils **L5** (S.W.), **L6** (M.W.), **L6, L7** (L.W.) are tuned by **C27,** with parallel trimming by **C28** (S.W.), **C29** (M.W.), **C6, C30** (L.W.), and series tracking by **C9** (S.W.), **C8** (M.W.), **C7, C8** (L.W.). Capacitative reaction coupling, due to the common impedance of trackers **C8, C9** in grid and anode circuits, is employed on all bands, with additional inductive coupling by **L8** on S.W.

Second valve **(V2, Osram KTW61)** is a variable-mu R.F. pentode operating as intermediate frequency amplifier with tuned transformer couplings **C31, L9, L10, C32** and **C33, L11, L12, C34.**

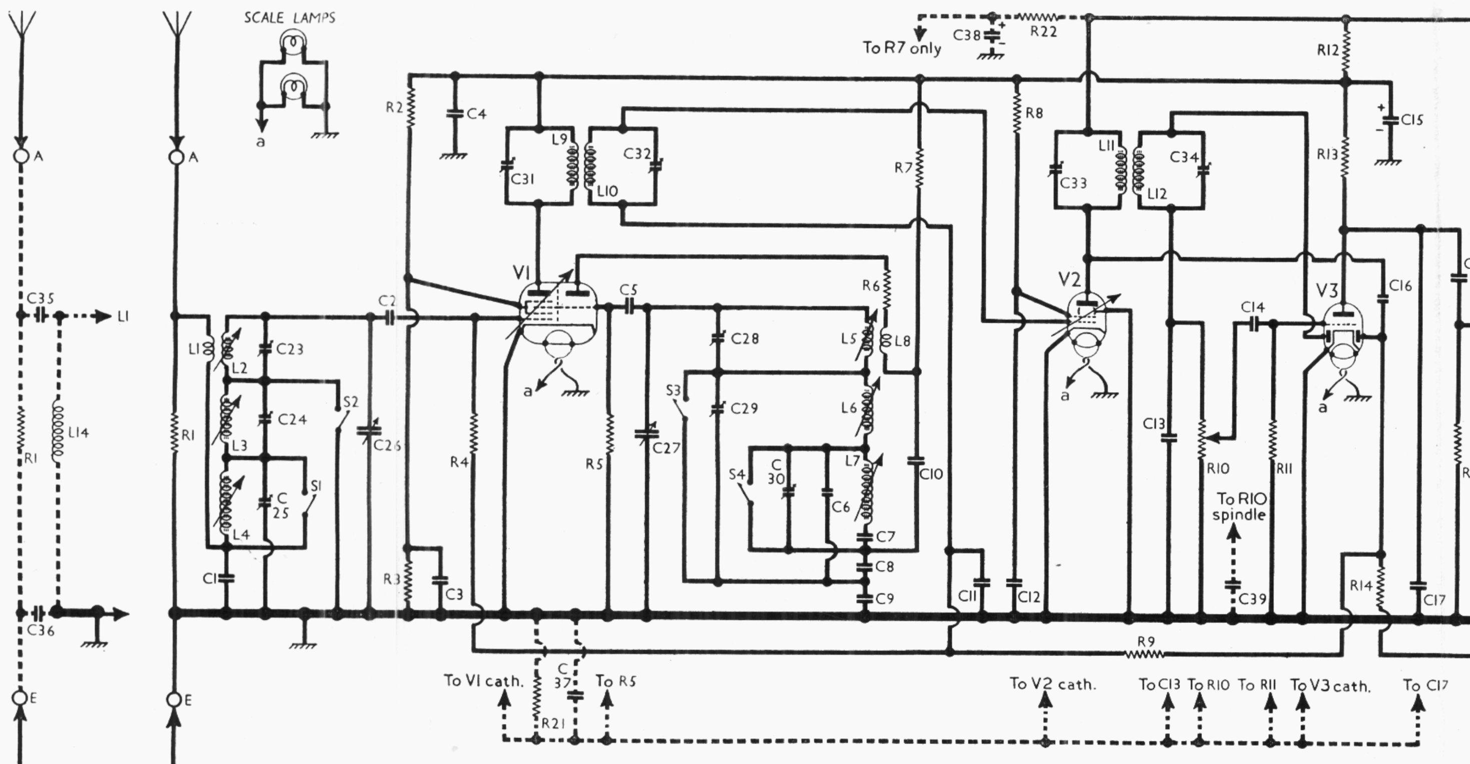
Intermediate frequency 456 kc/s.

Diode second detector is part of double diode triode valve **(V3, Osram DH63).** Audio frequency component in rectified output is developed across manual volume control **R10,** which is the load resistor, and passed via **C14, R11** to grid of triode section, which operates as A.F. amplifier. I.F. filtering by **C13** and **C17** in diode and triode anode circuits respectively.

Second diode of **V3,** fed from **V2** anode via **C16,** provides D.C. potential, which is developed across load resistor **R14** and fed back through a decoupling circuit **R9, C11** as G.B. to F.C. and I.F. valves, giving automatic gain control.

Resistance-capacitance coupling by **R13, C18, R15** between **V3** triode and beam tetrode output valve **(V4, Osram KT61)** (or KT33C in A.C./D.C. version). Fixed tone correction in anode circuit by **C20,** and variable tone control by **R17, C19.**

In the A.C. version, H.T. current is supplied by full-wave rectifying valve **(V5, Osram U50).** Smoothing by resistor **R19** and electrolytic capacitors **C21, C22,** residual hum being neutralized by passing the



Circuit diagram of the G.E.C. BC4940-45 series. The complete circuit of the A.C. model is drawn in solid lines. Where differences occur in the A.C./D.C. model, these are indicated by broken lines. In some cases, such as **R22, C38,** these are additions to the A.C. circuit; in others, such as the aerial and mains input circuits, they replace parts of the A.C. circuit. In the A.C./D.C. circuit **V1, V2** and **V3** have a common cathode line, and the A.V.C. diode load resistor **R14** goes directly to chassis.

receiver H.T. current through a portion of the output transformer **T1** primary. H.T. circuit R.F. filtering by **C4.** Fixed G.B. for **V1, V2** and A.G.C. delay voltage is obtained from the drop across **R20** in the H.T. negative lead to chassis.

In the A.C./D.C. version, H.T. current is supplied by I.H.C. half-wave rectifying valve **(V5, Osram U31),** which with D.C. mains behaves as a low resistance, and the valve heaters, together with scale lamps, barretter type 304, and mains R.F. filter chokes **L15, L16** are connected in series across mains input.

The rest of the circuit remains unchanged, apart from the fact that **R7** is fed from **C22** via a decoupling circuit **R22, C38.** Since **R20** is omitted, fixed G.B. for **V1, V2** and A.G.C. delay voltage is obtained from the drop across **R21** in the common cathode circuit of **V1, V2, V3** to chassis. The spindle of **R10** is "earthed" via **C39, V4** G.B. resistor **R18** is by-passed by **C40,** and the connecting leads to chassis from **T1** secondary winding and the speaker frame are omitted.

VALVE ANALYSIS

Valve voltages and currents in the tables (next col.) are those measured in our receivers when they were operating on A.C. mains of 228 V. The receivers were tuned to the lowest wavelength on the M.W. band, and the volume controls were at maximum, but there was no signal input.

Voltages were measured on the 400 V scale of a model 7 Avometer, except where otherwise indicated, chassis being the negative connection.

Valve	Anode V	Anode mA	Screen V	Screen mA	Cath. V
A.C. Model					
V1 X61M	138 / Oscillator 68	2·3 / Oscillator 2·7	54	3·0	—
V2 KTW61	196	5·7	48	1·6	—
V3 DH63	60	0·6	—	—	—
V4 KT61	257	36·0	196	5·6	3·7§
V5 U50	268†	—	—	—	280
AC./D.C. Model					
V1 X61M	109 / Oscillator 92	0·4 / Oscillator 3·2	52	1·7	1·8
V2 KTW61	143	5·1	52	1·5	1·8
V3 DH63	52	0·5	—	—	1·8
V4 KT33C	190	56·0	143	8·3	7·4§
V5 U31	216†	—	—	—	200

† A.C. § 10V meter range.

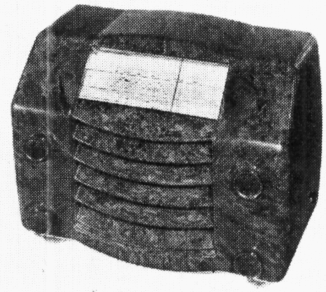
DISMANTLING THE SET

The cabinet is fitted with a detachable bottom cover (slide out), upon removal of which access may be gained to the majority of the under-chassis components.

Removing Chassis.—Pull off the four control knobs and remove the two milled-head screws (with spring washers) securing the top corners of the scale backing plate to the cabinet;

withdraw the four cheese-head chassis retaining screws (with spring and plain washers), and slide out the chassis to the extent of the speaker leads, which

(*Continued column 1, overleaf.*)

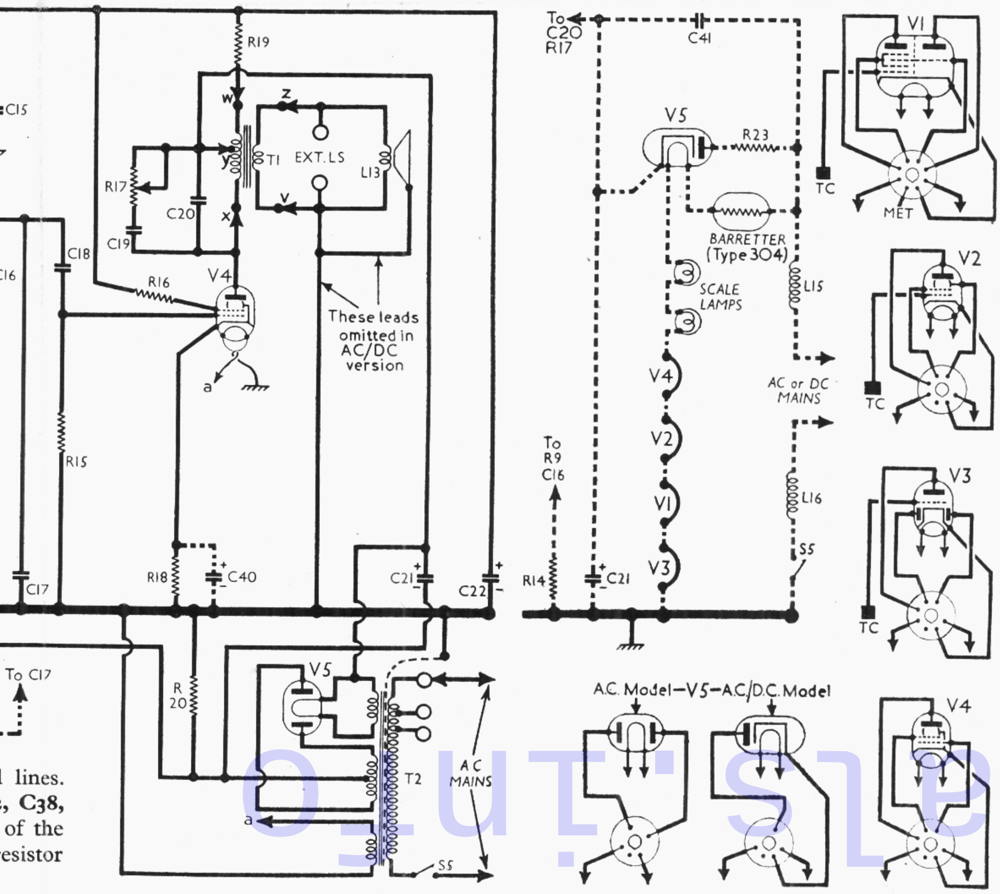


COMPONENTS AND VALUES

Resistors	A.C. Values (ohms)	A.C. Locations	A.C./D.C. Values (ohms)	A.C./D.C. Locations
R1	10,000	G5	1,000,000	F5
R2	15,000	F5	15,000	F5
R3	22,000	E5	22,000	E5
R4	1,000,000	F4	1,000,000	F4
R5	100,000	E5	100,000	E5
R6	390	E4	390	E4
R7	22,000	F4	6,800	F4
R8	56,000	H5	39,000	H5
R9	1,000,000	H5	1,000,000	H5
R10	1,000,000	D1	1,000,000	D1
R11	10,000,000	D1	10,000,000	D1
R12	4,700	K4	4,700	K4
R13	100,000	K5	100,000	K5
R14	470,000	J5	470,000	J5
R15	330,000	K3	330,000	K3
R16	100	K3	100	K3
R17	55,000	M3	55,000	M3
R18	91	K4	120	K4
R19	3,300	K4	2,200	K4
R20	39	L3	—	—
R21	—	—	150	F4
R22	—	—	6,800	J3
R23	—	—	180	L4

Capacitors	A.C. Values (μF)	A.C. Locations	A.C./D.C. Values (μF)	A.C./D.C. Locations
C1	0·00395	G4	0·00395	G4
C2	0·0001	F4	0·0001	F4
C3	0·05	E5	0·05	E5
C4	0·05	H4	0·05	H4
C5	0·0001	E4	0·000047	E5
C6	0·000039	E3	0·000039	E3
C7	0·00027	E4	0·00027	E4
C8	0·00043	E4	0·00043	E4
C9	0·00395	F3	0·00395	F3
C10	0·005	E4	0·005	E4
C11	0·05	G5	0·05	G5
C12	0·05	G5	0·05	G5
C13	0·0003	J4	0·0003	J4
C14	0·02	D1	0·02	D1
C15*	4·0	H4	4·0	H4
C16	0·000022	H5	0·000022	H5
C17	0·0005	J5	0·0005	J5
C18	0·02	K4	0·02	K4
C19	0·05	K3	0·1	K3
C20	0·005	J4	0·01	J3
C21*	16·0	A1	24·0	A1
C22*	20·0	H4	32·0	K5
C23‡	—	F4	—	F4
C24‡	—	F4	—	F4
C25‡	—	F3	—	F3
C26†	—	D1	—	D1
C27†	—	D2	—	D2
C28‡	—	F4	—	F4
C29‡	—	F3	—	F3
C30‡	—	F3	—	F3
C31‡	—	D2	—	D2
C32‡	—	D2	—	D2
C33‡	—	C2	—	C2
C34‡	—	C2	—	C2
C35	—	—	0·001	G5
C36	—	—	0·02	F5
C37	—	—	0·05	E5
C38*	—	—	8·0	H3
C39	—	—	0·001	D1
C40*	—	—	25·0	H4
C41	—	—	0·01	L5

* Electrolytic. † Variable. ‡ Pre-set.



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OTHER COMPONENTS		Approx. Values (ohms)	Locations
L1	Aerial S.W. coup. ...	0·06	G4
L2	Aerial tuning coils	0·23	G4
L3	Aerial tuning coils	2·4	G4
L4	Aerial tuning coils	19·5	G3
L5	Oscillator tuning coils	0·32	E4
L6	Oscillator tuning coils	3·1	E4
L7	Oscillator tuning coils	7·0	E4
L8	Osc. S.W. react ...	0·07	E4
L9	1st I.F. trans. Pri.	7·0	D2
L10	1st I.F. trans. Sec.	7·0	D2
L11	2nd I.F. trans. Pri.	4·0	C2
L12	2nd I.F. trans. Sec.	4·0	C2
L13	Speech coil ...	2·8	—
T1	Output trans. Pri., x-y	430·0	J4
	Pri., w-y	20·0	
	Sec.	0·37	
T2	Mains trans. Pri., total	34·0	A2
	Heat. sec.,	0·16	
	Rect. heat. sec.	0·14	
	H.T. sec., total	310·0	
S1-S4	W/band switches	—	E3
S5	Mains sw., g'd R17	—	M3
In A.C./D.C. Model only			
L14	Aerial shunt ...	50·0	F4
L15	Mains R.F. filter chokes	1·2	L4
L16	Mains R.F. filter chokes	1·2	L4
T1	Output trans. Pri., x-y	160·0	J4
	Pri., w-y	15·0	
	Sec.	0·2	

(Dismantling the Set—*continued*)

is sufficient for most service purposes. To free the chassis entirely, unsolder the speaker leads.

Removing Speaker.—Remove chassis as previously described, slacken the screws of the four speaker retaining clamps, swivel the clamps aside, and lift out the speaker.

When replacing, the speech coil tags should be at the bottom, and the black connecting lead must be resoldered to the left-hand tag, to which is joined an earthing lead from the speaker chassis.

GENERAL NOTES

Switches.—S1-S4 are the waveband switches, ganged in a single 3-position rotary unit beneath the chassis. The unit

Switch	L.W.	M.W.	S.W.
S1	—	C	C
S2	—	—	C
S3	—	—	C
S4	—	C	C

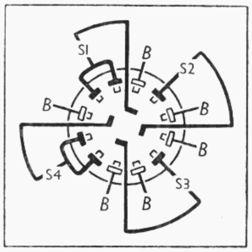


Diagram of the waveband switch unit, drawn as seen when viewed from the rear of an inverted chassis. Above it is the associated switch table.

is indicated in our under-chassis illustration, and shown in detail in the diagram above, where it is drawn as seen when viewed from the rear of an inverted chassis.

The table above gives the switch positions for the three control settings, starting from the fully anti-clockwise (L.W.) position of the control knob. A dash indicates open, and **C**, closed.

S5 is the Q.M.B. mains switch, ganged with the tone control **R17**.

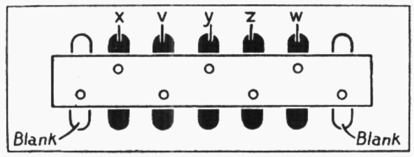
Scale Lamps.—The same type of scale lamp is used in the A.C. and A.C./D.C. versions, and the makers' type No. for it is O.S.75. Two lamps are used in each chassis, and they have small, clear, spherical bulbs and M.E.S. bases. They are rated at 6.5 V, 0.3 A.

External Speaker.—Two terminals are provided at the rear of the A.C. chassis for the connection of a low-impedance (about 2-4 Ω) external speaker. In the A.C./D.C. versions sockets are provided instead of terminals, as in the case of the **A** and **E** connections. In the A.C. model the speech coil circuit is connected to chassis, but in the A.C./D.C. model it is not.

Low-voltage model.—The BC4940L is a special version of the A.C. model 4940 employing a mains transformer whose primary is tapped at 115 V, 125 V and 220 V. The overall D.C. resistance of the winding is 26 Ω; from the fixed end to the 115 V tapping it is 10.5 Ω; and from the fixed end to the 125 V tapping it is 11.5 Ω. There is no low-voltage version of the A.C./D.C. model BC4945.

CIRCUIT ALIGNMENT

These operations may be carried out with the chassis in the cabinet, but since a calibrated scale is printed on the front of the cursor guide rail they are more conveniently performed with the chassis on the bench. In the following instructions both the wavelength (identified by a spot) on the glass tuning scale to which the cursor should be set, and the corresponding position of the cursor carriage in



Alternative arrangement of tags on the connecting panel on the output transformer **T1** in the A.C./D.C. receiver.

degrees, measured against the left-hand (red) side of the cursor carriage, are quoted.

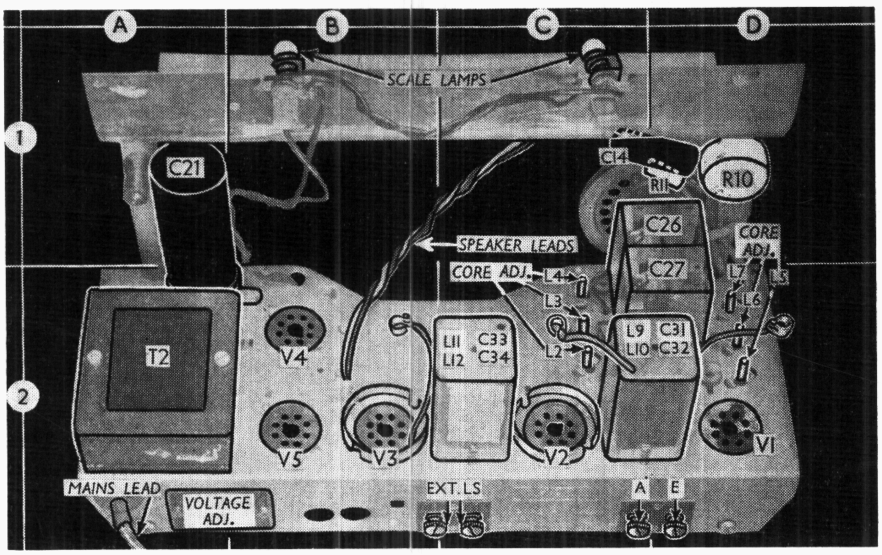
At the conclusion of each set of operations the input signal, in micro-volts, required to produce an output of 50 mW (19 V A.C. across **C20**) is given in parenthesis, and variations within the limits of +100% and −50% should be considered satisfactory.

I.F. Stages.—Switch set to L.W., turn gang and volume control to maximum, connect signal generator (via an 0.01 μF capacitor in the "live" lead) to control grid (top cap) of **V2** and the **E** terminal. Feed in a 456 kc/s (657.8 m) signal, and adjust **C34** and **C33** (location reference C2) for maximum output (1,500 μV).

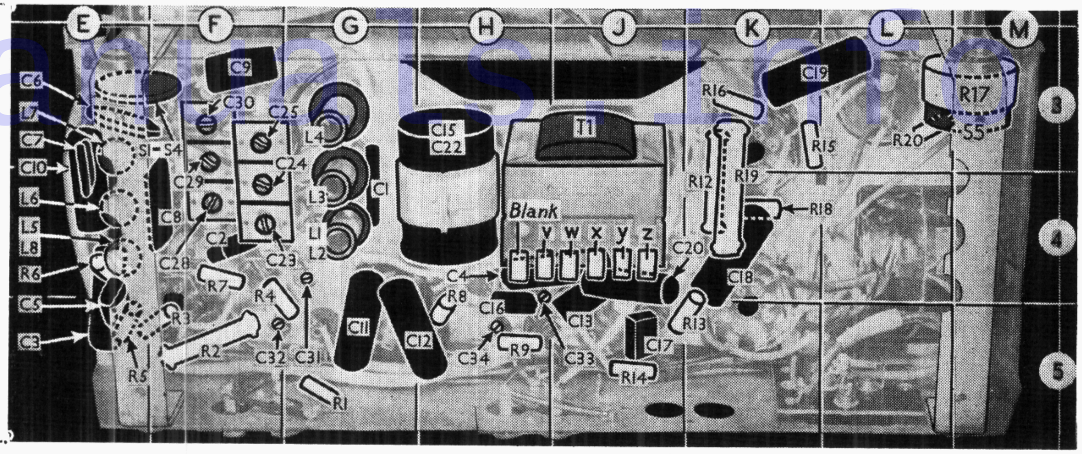
Transfer "live" signal generator lead and series capacitor to control grid (top cap) of **V1** and chassis, feed in a 456 kc/s signal, and adjust **C32** and **C31** (D2) for maximum output. Do not readjust **C33, C34.** (25 μV).

R.F. and Oscillator Stages.—With the gang at maximum capacitance the cursor should be vertical and coincident with the brown dot (90 deg) at the high wavelength end of the L.W. scale. It may be adjusted in position by rotating the drive drum on its spindle, after slackening the two boss screws. Transfer "live" signal generator lead to **A** terminal, via a suitable dummy aerial.

S.W.—Switch set to S.W., tune to 50 m (86 deg), feed in a 50 m (6 Mc/s) signal, and adjust the cores of **L5** (D2)



Plan view of the A.C. chassis, with the R.F. and oscillator coil core adjustments identified. **V2** and **V3** are provided with screening cans. In the A.C./D.C. version, the mains transformer **T2** is replaced by the barretter lamp.



Under-chassis view of the A.C. model. The positions of the components in the A.C./D.C. version are indicated approximately by the location references in the component tables. An alternative arrangement of tags on the connecting panel of the output transformer T1 in the A.C./D.C. version is given in col. 3.

and **L2** (C2) for maximum output. Tune to 16.7 m (6.5 deg), feed in a 16.7 m (18 Mc/s) signal, and adjust **C28** (F4) and, while rocking the gang, **C23** (F4) for maximum output, choosing the peak on **C28** involving the lesser capacitance. Repeat these operations until no improvement results. (50 m = 26 μV; 16.7 m = 11 μV).

M.W.—Switch set to M.W., tune to 500 m (73.5 deg), feed in a 500 m (600 kc/s) signal, and adjust the cores of **L6** (D2) and **L3** (C2) for maximum output. Tune to 214 m (8.5 deg), feed in a 214 m (1,402 kc/s) signal, and adjust **C29** (F3) and **C24** (F4) for maximum output. Repeat these operations until no improvement results. (500 m = 10 μV; 214 m = 13 μV).

L.W.—Switch set to L.W., tune to 1,875 m (72.5 deg), feed in a 1,875 m (160 kc/s) signal, and adjust the cores of **L7** (D2) and **L4** (C2) for maximum output. Tune to 1,000 m (11 deg), feed in a 1,000 m (300 kc/s) signal, and adjust **C30** (F3) and **C25** (F3) for maximum output. Repeat these operations until no improvement results. (1,875 m = 20 μV; 1,000 m = 23 μV).

DRIVE CORD REPLACEMENT

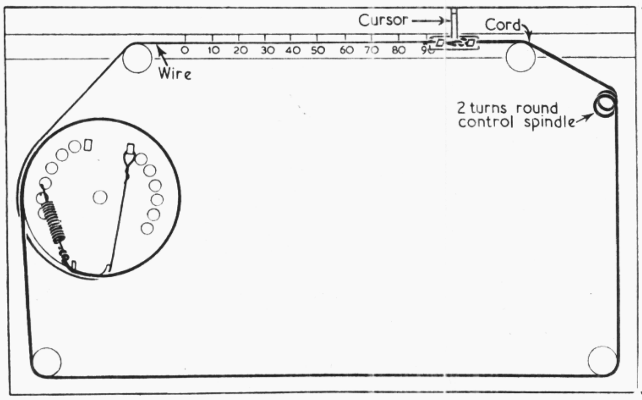
The drive cord for the tuning drive system consists of two sections, one part being a length of stranded steel wire, and one of stout twine, and it is convenient to make up the two sections and tie them together before fitting them. Suitable materials for the cord may be obtained from the G.E.C. Service Depot, Greycoat Street, Westminster, London, S.W.1.

Make up the wire with a loop of about ⅛-inch diameter at each end so that it measures 16½ inches overall. Take about four feet of the twine and tie one end of it with a non-slip knot to one end of the wire. The wire joints can easily be sealed by a touch of solder, and it is advisable to apply a dab of cellulose or some sealing compound to the twine knot.

Turn the gang to maximum, when the drum should take up the position shown in our sketch below. Hook the free end of the wire to the anchor tag shown and run the wire down through the right-hand slot and clockwise half-way round the drum, then off to the cursor carriage as shown in the sketch.

Continuing the run, make two turns clockwise round the control spindle, starting hard up against the boss at the base (so that the turns travel outwards when the spindle is turned) and so on round to the gang drum. There, tie off the twine fairly short to one end of the tension spring, hooking the other end of the spring in the appropriate hole to give the required tension.

Clamp the cord under the tags on the cursor carriage, the join between the two sections being about central. The left-hand edge of the carriage should now be level with the 90 deg mark on the alignment scale. Adjustment may be made by turning the drum on the gang spindle.



Sketch showing the tuning drive system, which is the same in both A.C. and A.C./D.C. versions. It is drawn as seen from the front of the chassis when the gang is at maximum, in which position the new cord should be fitted.

Service Short-cuts

BELMONT 856

An unusual fault, which might occur in any superhet employing Litzendraht-wound I.F. transformers, was found in one of these receivers. The customer complained that the set would go "woolly" at times, with a "hissing" noise that would build up to a peak until suddenly, with a click in the speaker, reception would be normal for a few seconds. Then the process was repeated.

This type of trouble is usually due to a faulty multi-electrode valve (and does not show up on the average tester) or a faulty coupling capacitor, but in this case it was traced by systematic testing to the first I.F. transformer: the D.C. resistance of the secondary winding was about twice the value quoted by the makers, and the ohmmeter pointer would not settle down to a steady value.

On close inspection, several strands of the wire were found to be broken at the terminating point, where there was a "dry" joint. Careful cleaning, tinning and re-soldering effected a perfect cure.—**H. R. G.**, Portishead.

VOLTAGE-DOUBLERS

Here is a dodge that may prove of interest to service men. I have recently had a number of cases where reservoir capacitors in sets with metal rectifiers in voltage-doubling circuits have been giving trouble.

In each instance the capacitor has been a replacement rated at 500V, but owing to the very small H.T. current drain when first switched on, the voltage across the capacitor has flown up to approximately $200 \times \sqrt{2} \times 2$: i.e. about 560V.

I have tried various ways of overcoming the trouble, but found that any system of resistors which reduced the initial surge to a safe figure resulted in a very low H.T. voltage when the valves warmed up. Finally it occurred to me that a "Brimistor" resistor had just the required characteristic for the job, and I fitted one in the lead to the centre of the rectifier.

The idea works perfectly. The voltage across the capacitor rises to 350V upon switching on, rises slowly to 420V as the Brimistor begins to warm up, drops to 300V as the valves begin to draw current, and rises again to 350V when the Brimistor attains its full working temperature.

I found that type CZ2 gave rather better results in my case than the CZ1, and as the current was about 100mA the safety factor was adequate.—**H. E. McG.**, Roke.

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