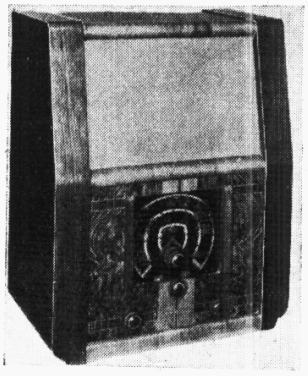
Supplement to The Wireless & Electrical Trader, May 20, 1944

"TRADER" SERVICE SHEET 672

PHILCO C638 CA638 AND A638ARG



The Philco C638 superhet.

PROVISION is made in the Philco C638 receiver for the connection of a SW dipole aerial, an all-wave anti-static aerial or an ordinary open aerial, a special aerial panel being fitted for the purpose. This panel also carries pick-up and external speaker sockets.

The receiver is a 5-valve (plus rectifier) 3-band superhet designed to operate from AC mains of 200-250 V, 50-100 c/s. The SW range is 16.6-51.7 m (marked on scale as 18-5.8 Mc/s).

Two other models, the CA638 (table) and A638ARG autoradiogram, are also covered by this *Service Sheet*, the differences being explained overleaf, *but it must be emphasised that the A638BG is not covered.* A method of identifying the A638BG is given overleaf.

Release dates: C638, A638ARG, March, 1938; *CA638, December*, 1938.

Original prices: C638, £12 12*s.*; *CA638*, £14 3*s.* 6*d.*; *A638ARG*, £35 14*s.*

CIRCUIT DESCRIPTION

Arrangements are made for the use of a dipole aerial or an ordinary aerial on SW, and for an ordinary aerial or Philco all-wave noise reducing aerial on all bands. The link is inserted in socket **C** for dipole operation, and in **B** for the anti-static aerial.

Aerial input on SW is via sockets **A** and **B** for a dipole, **S1** connecting **C** to chassis via the link; or from an ordinary aerial via socket **A,** to coupling coil **L1** and single tuned circuit **L3, C38.**

On MW and LW input is via socket **A, L1,** the link, and coupling coil **L2,** to single tuned circuits **L4, C38** (MW) and **L5, C38** (LW). The **Red** and **Black** sockets are for use with the anti-static aerial.

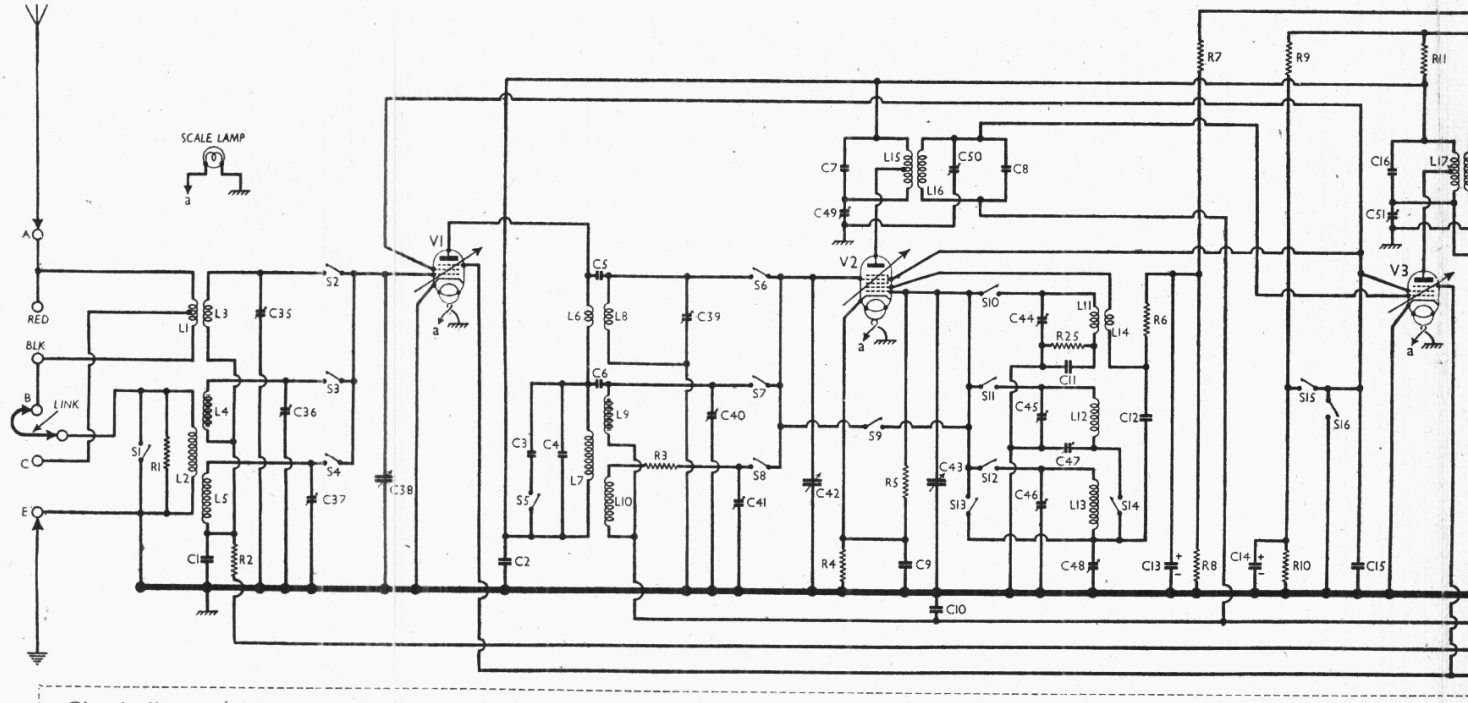
First valve **(V1, Philco 78E)** is a variable-mu RF pentode operating as signal frequency amplifier, with tuned-secondary RF transformer coupling by **L6, L8, C42** (SW); **L7, L9, C42** (MW); and **L7, L10, C42** (LW) to second valve **(V2, Philco 6A7),** a heptode operating as frequency changer with electron coupling. **L7** is shunted by **C4** (all bands) and **C3** (LW and SW). Top coupling by **C5** (SW) and **C6** (MW).

V2 triode oscillator grid coils **L11** (SW), **L12** (MW) and **L13** (LW) are tuned by **C43.** Parallel trimming by **C44** (SW), **C45** (MW) and **C46** (LW); series tracking by **C11** (SW), **C47, C48** (MW) and **C48** (LW). Reaction coupling from anode via **L14** (SW), and common impedance of trackers **(C47** and **C48** on MW; **C48** only on LW) in grid and anode circuits.

Third valve **(V3, Philco 78E)** is a second variable-mu RF pentode, operating this time as intermediate frequency amplifier with tuned-primary, tuned-secondary transformer couplings **C7, C49, L15, L16, C50, C8** and **C16, C51, L17, L18, C52, C17.** Excepting the case of **L16** and the feed to the AVC diode, all input and output connections are taken at centre-tap points of coils.

Intermediate frequency 470 kc/s.

Diode second detector is part of double diode triode valve **(V4, Philco 75).** Audio frequency component in rectified output is



Circuit diagram of the Philco C638 3-band AC superhet. The six lettered sockets in the aerial circuit are arranged to accept a normal open aeria wave dipole. On gram, **S15** and **S16** disconnect the screen grids of valves **V1, V2** and **V3** from their HT feed and connect them instead to c the pre-set IF tuning condensers are returned to chassis. The differences in the CA638 and the A638ARG autoradiogram are de

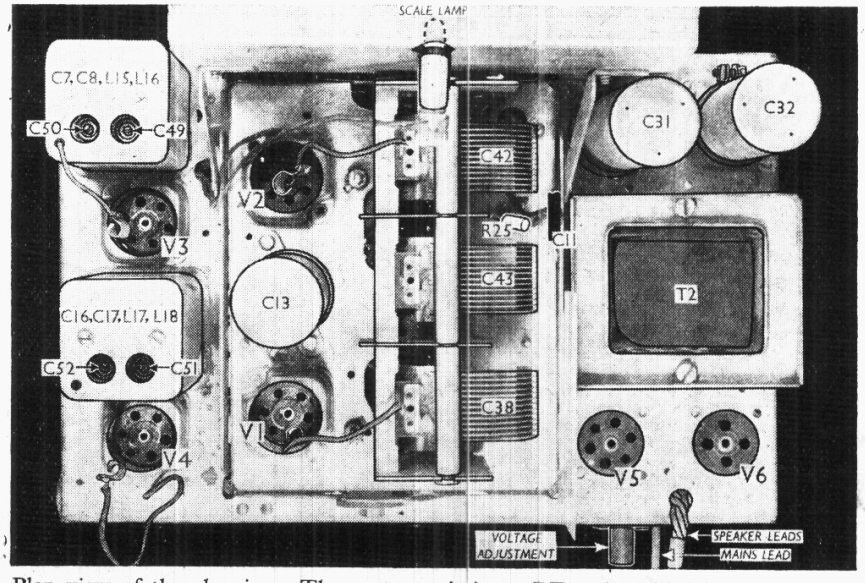
developed across load resistor **R13** and passed via switch **S17,** manual volume control **R14** and AF coupling condenser **C23** to CG of triode section, which operates as AF amplifier.

IF filtering by **C18, R12** and **C19** in diode circuit, and **C24** in triode anode circuit. High-note tone compensation by **C22,** and bass compensation by **C21,** in **R14** circuit. Provision for connection of gramophone pick-up via **S18** across **R14, C21,** and as switching is provided, it may be left permanently connected. When the control is turned to gram, apart from the opening of **S17** and closing of **S18, S15** opens, depriving **V1-V3** SG's of their HT supply, while **S16** connects them to chassis. In addition, waveband switches **S4, S9, S13** and **S14** close on gram.

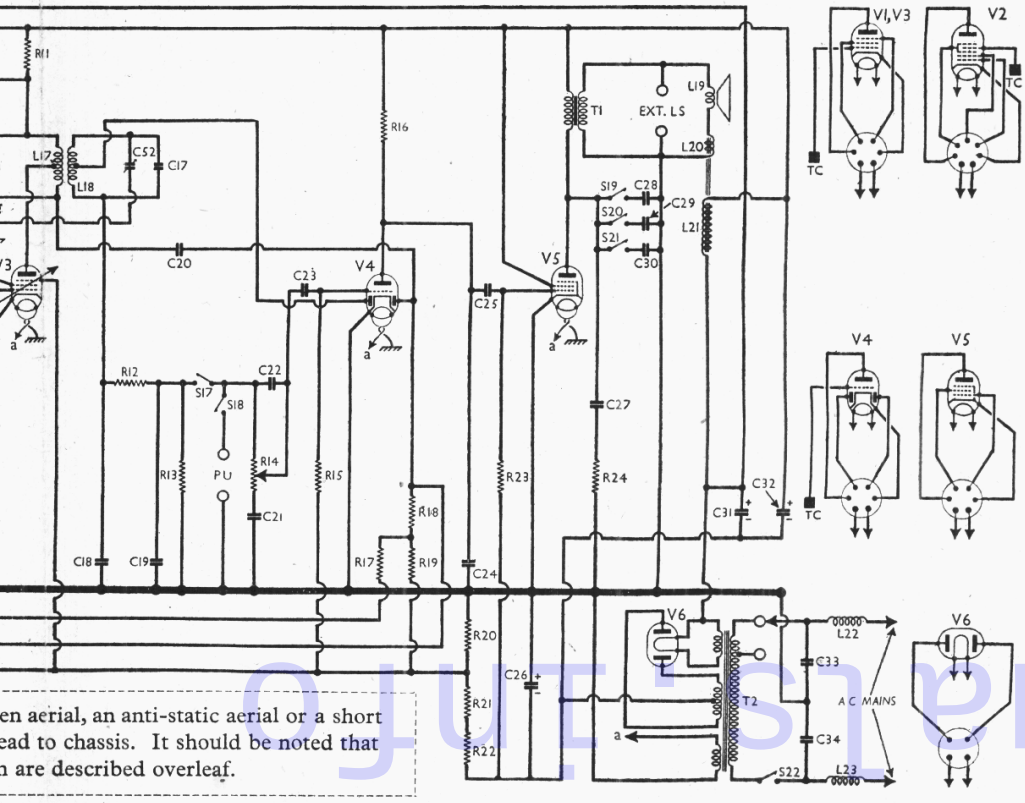
Second diode of **V4,** fed from **L17** via **C20,** provides DC potentials which are developed across load resistors **R18, R19** and fed back through decoupling circuits as GB to RF, FC and IF valves on all bands (excepting SW in FC circuit) giving automatic volume control.

Resistance-capacity coupling by **R16, C25** and **R23** between **V4** triode and pentode output valve **(V5, Philco 42E).** Four-position tone control by **C27, R24** and **C28, C28, C30** controlled by **S19, S20.** Provision for connection of low-impedance external speaker across secondary winding of internal speaker input transformer **T1.**

HT current is supplied by full-wave rectifying valve **(V6, Philco 80).** Smoothing of main HT line by speaker field **L21** and wet electrolytic condensers **C31, C32,** while a separate HT line to **V2 oscillator** circuit is fed via **R6** from the potential divider **R7, R8** with smoothing by **R7** and electrolytic condensers **C31, C13. C13** is returned directly to chassis, but **C31, C32** return to HT negative, which in turn runs to chassis via a potential divider **R20, R21, R22,** from which GB potentials for all valves and AVC delay potential are obtained. This circuit is by-passed by **C26.** Additional GB for **V2** is obtained from the drop along **R4** in its cathode circuit. Mains input RF filtering by **L22, L23** and **C33, C34.**



Plan view of the chassis. The centre unit is an RF and oscillator sub-chassis, resiliently mounted on the main chassis. **R25** may not be present in some C638 models.



en aerial, an anti-static aerial or a short ead to chassis. It should be noted that n are described overleaf.

COMPONENTS AND VALUES

	CONDENSERS	Values (μF)
C1	V1 CG decoupling ...	0·05
C2	V1–V3 anodes decoupling	0·1
C3	RF trans. primary shunt	0·00007
C4	condensers	0·00005
C5	RF trans. "top" coupling condensers ...	0·000014
C6		0·000005
C7	1st IF trans. fixed tuning	0·00007
C8	condensers	0·00007
C9	V2 cathode by-pass ...	0·1
C10	AVC line decoupling ...	0·05
C11	Osc. circ. SW tracker ...	0·003
C12	Osc. reaction coupling ...	0·001
C13*	V2 osc. anode decoupling	16·0
C14*	V1–V3 SG's decoupling...	4·0
C15	V1–V3 SG's RF by-pass	0·01
C16	2nd IF trans. fixed tuning	0·00007
C17	condensers	0·00007
C18	IF by-pass condensers...	0·00011
C19		0·00011
C20	Coupling to V4 AVC diode	0·00011
C21	Bass compensator ...	0·02
C22	High note compensator...	0·00011
C23	V4 triode CG condenser	0·01
C24	IF by-pass	0·00011
C25	V5 CG condenser ...	0·05
C26*	Auto GB circuit by-pass	10·0
C27	Part fixed tone corrector	0·002
C28	Tone control condensers	0·006
C29		0·01
C30		0·02
C31*	HT smoothing condensers	16·0
C32*		16·0
C33	Mains RF filter condensers	0·09
C34		0·09
C35‡	Aerial circ. SW trimmer	0·00003
C36‡	Aerial circ. MW trimmer	0·00003
C37‡	Aerial circ. LW trimmer	0·00011
C38†	Aerial circuit tuning ...	—
C39‡	RF trans. sec. SW trimmer	0·00003
C40‡	RF trans. sec. MW trimmer	0·000015
C41‡	RF trans. sec. LW trimmer	0·00008
C42†	RF trans. sec. tuning ...	—
C43†	Osc. circuit tuning ...	—
C44‡	Osc. circ. SW trimmer...	0·00003
C45‡	Osc. circ. MW trimmer...	0·00003
C46‡	Osc. circ. LW trimmer...	0·00011
C47‡	Osc. circ. MW tracker ...	0·000375
C48‡	Osc. circ. LW tracker ...	0·000120
C49‡	1st IF trans. pri. tuning	—
C50‡	1st IF trans. sec. tuning	—
C51‡	2nd IF trans. pri. tuning	—
C52‡	2nd IF trans. sec. tuning	—

* Electrolytic. † Variable. ‡ Pre-set.

	RESISTORS	Values (ohms)
R1	Aerial circuit shunt ...	10,000
R2	V1 CG decoupling ...	1,000,000
R3	RF trans. LW damping	100
R4	V2 fixed GB resistor ...	400
R5	V2 osc. CG resistor ...	99,000
R6	V2 osc. anode HT feed...	32,000
R7	V2 osc. anode HT feed	25,000
R8	potential divider ...	70,000
R9	V1, V2, V3 SG's HT	25,000
R10	potential divider ...	35,000
R11	V1, V2, V3 anodes HT feed	2,000
R12	IF stopper	51,000
R13	V4 signal diode load ...	240,000
R14	Manual volume control...	1,000,000
R15	V4 triode CG resistor ...	1,500,000
R16	V4 triode anode load ...	160,000
R17	AVC line decoupling ...	490,000
R18	V4 AVC diode load	490,000
R19	resistors	240,000
R20	V1–V5 GB and AVC	18
R21	delay potential divider	200
R22	resistors	126*
R23	V5 CG resistor	240,000
R24	Part fixed tone corrector	5,000
R25	Osc. SW damping ...	32,000

* Made up of two 63Ω resistors connected in series.

	OTHER COMPONENTS	Approx. Values (ohms)
L1	Aerial SW coupling coil...	0·1
L2	Aerial MW and LW coupling	60·0
L3	Aerial SW tuning coil ...	Very low
L4	Aerial MW tuning coil ...	2·5
L5	Aerial LW tuning coil ...	40·0
L6	RF trans. SW pri. coil ...	2·0
L7	RF trans. MW and LW pri.	60·0
L8	RF trans. SW sec. coil ...	Very low
L9	RF trans. MW sec. coil ...	2·5
L10	RF trans. LW sec. coil ...	50·0
L11	Osc. SW tuning coil ...	Very low
L12	Osc. MW tuning coil ...	2·5
L13	Osc. LW tuning coil ...	16·5
L14	Osc. SW reaction coil ...	0·1
L15	1st IF Pri., total ...	8·0
L16	trans. Sec. ...	8·0
L17	2nd IF Pri., total ...	8·0
L18	trans. Sec., total ...	8·0
L19	Speaker speech coil ...	2·0
L20	Hum neutralising coil ...	0·1
L21	Speaker field coil ...	1,140·0
L22	Mains RF filter chokes...	2·5
L23		2·5
T1	Speaker input trans. Pri. ...	265·0
	Sec. ...	0·2
T2	Mains trans. Pri., total ...	35·0
	Heater sec. ...	0·2
	Rect. heat. sec.	0·1
	HT sec., total	480·0
S1–S14	Waveband switches ...	—
S15–S18	Radio/gram. change switches	—
S19–S21	Tone control switches ...	—
S22	Mains switch, ganged S19–S21	—

DISMANTLING THE SET

Removing Chassis.—Remove the five control knobs (pull-off) from the front of the cabinet; remove from the rear chassis member the small hexagon self-threading earthing screw, releasing the braided copper lead connected to screening foil in the base of the cabinet; remove the four hexagon self-threading screws (with metal washers) holding the chassis to the bottom of the cabinet.

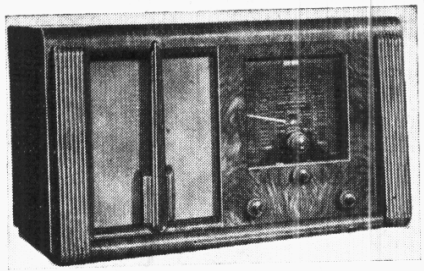
The chassis may now be withdrawn to the extent of the speaker leads, which is sufficient for normal purposes.

To free the chassis entirely, unsolder from the connecting panel on the speaker transformer the leads connecting it to chassis.

When replacing, connect the speaker leads as follows, numbering the tags on the right-hand side of the connecting panel from top to bottom: 1, green/white; 2, green; 3, white. The black lead goes to the upper tag of the pair on the left-hand side of the panel, and the red lead to the lower one.

Removing Speaker.—Remove the six square nuts (with lock-washers) holding the speaker rim to the sub-baffle.

When replacing, the transformer should be on the right, when viewed from the rear, and if the leads have been unsoldered, they should be connected as previously described.



The Philco CA638 receiver.

VALVE ANALYSIS

Valve voltages and currents given in the table below are those measured in our receiver when it was operating on mains of 235 V, using the 230-250 V tapping on the mains transformer.

The receiver was tuned to the lowest wavelength on the MW band, and the volume control was at maximum, but there was no signal input.

Voltages were measured on the 400 V scale of a model 7 Universal Avometer, whose negative lead was connected to chassis.

Valve	Anode Voltage (V)	Anode Current (mA)	Screen Voltage (V)	Screen Current (mA)
V1 78E	245	4·1	75	1·1
V2 6A7	245	0·8	75	2·3
	Oscillator			
	120	2·5		
V3 78E	245	4·3	75	1·2
V4 75	140	0·9	—	—
V5 42E	265	40·0	275	8·0
V6 80	320†	—	—	—

† Each anode, AC.

GENERAL NOTES

Switches.—**S1-S14** are the waveband switches, and **S15-S18** the radio muting and pick-up switches, ganged in two rotary units beneath the chassis. These are indicated in our under-chassis view, and shown in detail in the diagrams in col. 3, while in the table (col. 3) are shown the switch positions for the four control settings, starting from the fully anti-clockwise position of the control. A dash indicates open, and **C**, closed.

S19-S21 are the tone control switches, and **S22** the QMB mains switch, ganged together and mounted on the front chassis member. Altogether, the control has five positions. In the fully anti-clockwise position of the control, all the switches are open; in the next position, **S22** closes; then **S19, S20** and **S21** close in succession, in that order as the control is turned clockwise, each switch remaining closed as the control is advanced, so that when **S21** closes, **S19-S22** are all closed.

Coils.—**L1** is the SW aerial coupling coil, centre-tapped for use with a dipole aerial or anti-static aerial, in association with the multi-socketed aerial panel, as explained at the beginning of "Circuit Description." The aerial circuit coils **L1, L3** and **L2, L4, L5** are in two tubular units mounted in the rear section beneath the RF sub-chassis. The RF transformers **L6, L8** and **L7, L9, L10,** and the oscillator coils **L11, L14** and **L12, L13** are in four further tubular units, mounted in the front section of the sub-chassis. The associated switch units, pre-set condensers and other components are also fitted in their respective RF compartments.

The IF transformers **L15, L16** and **L17, L18** are in two screened units on the chassis deck, each containing its associated fixed and pre-set tuning condensers but no other components. **L15, L17** and **L18** are centre-tapped, and the pre-set condensers are returned to chassis.

Scale Lamp.—This is a Tung-Sol tubular lamp, with an SBC cap, rated at 6.3 V, 0.35 A.

External Speaker.—Two sockets are provided on the connecting panel on the speaker transformer for the connection of a low impedance (about 3 Ω) external speaker.

Condensers C11, C47, C48.—C47, C48 are the MW and LW trackers respectively. They consist of a double unit. The outer section, **C48,** is adjusted by the nut. The remote section, **C47,** is adjusted by means of the screw.

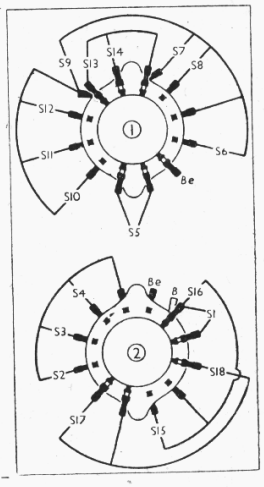
C11, although it may appear to be adjustable, should not be disturbed.

Condensers C31, C32.—These are two wet electrolytics in separate metal containers mounted in clips on the chassis deck. They are rated at 440 V peak, 460 V surge. It should be noted that the cases, which form the negative connection, are isolated from chassis.

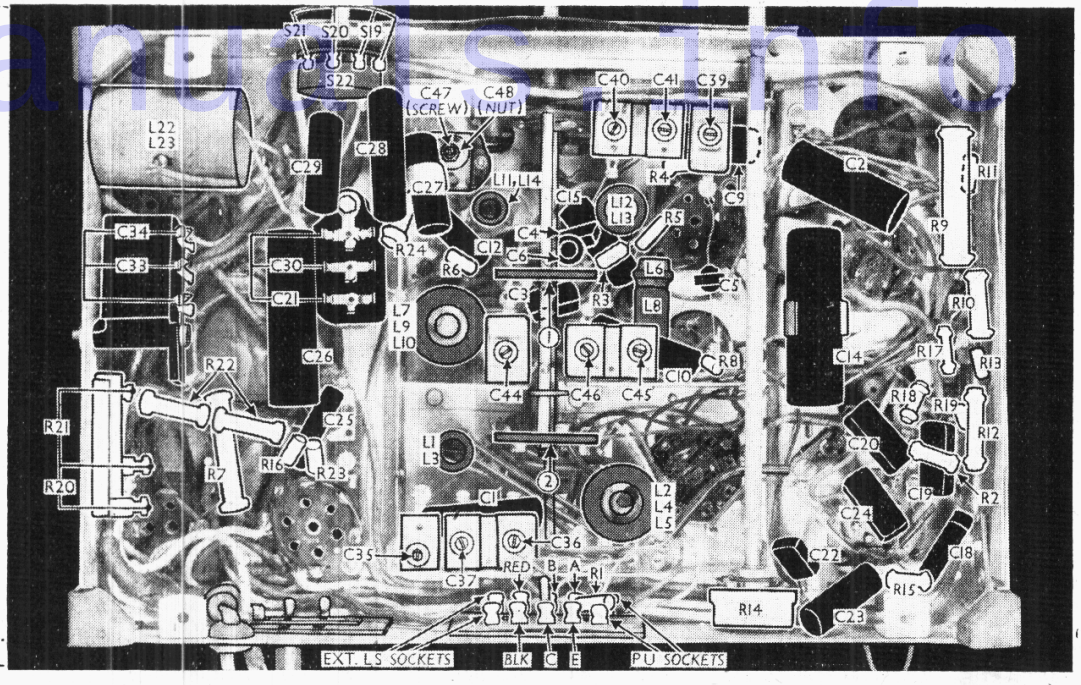
Resistors R20, R21, R22.—These are the auto GB resistors, and they form a potential divider in the negative HT lead to chassis. **R20** and **R21** are the two sections of a Candohm resistance unit, the respective tags being indicated in our under-chassis illustration. **R22** consists of two 63 Ω carbon resistors in series.

Chassis Divergencies.—In some cases, we found in our chassis small differences in the positions and values of components,

Diagrams of the two waveband switch units, as seen from the rear of the underside of the chassis. ***B*** indicates a blank tag, and ***Be*** a bearer. The switch table is given below the diagrams.



Switch	LW	MW	SW	Gram
S1	—	—	C	—
S2	—	—	C	C
S3	—	C	—	—
S4	C	—	—	—
S5	C	—	C	—
S6	—	—	C	—
S7	—	C	—	—
S8	C	—	—	—
S9	—	—	—	C
S10	—	—	C	—
S11	—	C	—	—
S12	C	—	—	—
S13	—	—	—	C
S14	—	C	C	C
S15	C	C	C	C
S16	—	—	—	—
S17	C	C	C	C
S18	—	—	—	—



Under-chassis view. All the RF and oscillator components are sunk, as seen in this illustration, into a well formed by the sub-chassis. The wave-band switch units are indicated here and shown in detail in the diagrams in col. 3. The tags of the tone control switch unit **S19 - S21** are clearly seen here, as are also the tags of **R20, R21,** The ten sockets on the panel at the rear of the chassis also are identified.

but as our sample was not new it may have been modified since it left the works.

For instance, **C31** and **C32** were transposed, and **R11,** although it feeds **V1** and **V2** anodes, does not feed **V3** anode, **L17** being connected to the HT positive line. We have shown such components in our circuit diagram and illustrations as indicated in the makers' manual.

R25, in parallel with **C11,** was not shown in the makers' instructions on the C638, but it was present in our chassis. It is shown in the manual on the CA638, however, and we have shown it also.

CIRCUIT ALIGNMENT

IF Stages.—Switch set to MW, turn tone control to first "On" position, turn volume control to maximum and insert aerial link to socket **B.** Connect signal generator leads to control grid (top cap) of **V2,** leaving existing connector in position, via a MW dummy aerial, and chassis, feed in a 470 kc/s (638.3 m) signal, and adjust **C51, C52,** then **C49, C50,** for maximum output.

RF and Oscillator Stages.—With gang at maximum capacity the pointer should coincide with the scale margin line. Transfer signal generator leads via a suitable dummy aerial (a 400 Ω resistor will serve on SW) to **A** and **E** sockets.

LW.—Switch set to LW, tune to 1,035 m on scale (calibration mark at about 14.6 Mc/s on outer edge of SW scale), feed in a 1,035 m (290 kc/s) signal, and adjust **C46, C37** and **C41** in that order for maximum output.

Tune to 1,875 m on scale (calibration mark at about 6.2 Mc/s on outer edge of SW scale), feed in a 1,875 m (160 kc/s) signal, and adjust **C48** (nut) for maximum output while rocking the gang for optimum results. Return to 1,035 m, readjust **C46,** and repeat the LW adjustments throughout.

MW.—Switch set to MW, tune to 214 m on scale (16 Mc/s on SW scale), feed in a 214 m (1,400 kc/s) signal, and adjust **C45, C36** and **C40** in that order for maximum output.

Tune to 500 m on scale, feed in a 500 m (600 kc/s) signal, and adjust **C47** (screw) for maximum output while rocking the gang for optimum results. Return to **C45** at 214 m and repeat the whole of the MW procedure until no improvement results.

SW.—Switch set to SW, tune to 18 Mc/s on scale, feed in a 18 Mc/s (16.67 m) signal, and adjust **C44** for maximum output. Two peaks will be found, and that used should be the one involving the lesser trimmer capacity. Now adjust **C35** and **C39** for maximum output.

Owing to the very small percentage difference between the signal and oscillator frequencies "pulling" may occur between them when adjusting **C35** and **C39.** It can be minimised by connecting a variable condenser in parallel with **C43** and tuning it (at about 0.00035 μF) to the second harmonic of the required oscillator frequency, using this instead of the fundamental to beat with the incoming signal.

If this has been done, remove the external condenser after adjustment and readjust **C44,** then check that the image appears at about 17.1 Mc/s on scale. If it does not, the wrong peak has been used.

CA638 MODIFICATIONS

The principal difference between the C638 and the CA638 lies in the addition of a "Shadow-meter" tuning indicator. Three scale lamps are used instead of one : one at each upper corner of the scale assembly, and one in the tuning indicator.

The meter winding has a DC resistance of 3,500 Ω, and it is inserted in the HT feed lead to **V1** anode, between **C2** and **L7,** and at its junction with **L7** a 0.02 μF by-pass condenser is taken off to chassis.

The top end of **R5** is connected to the bottom of **L13,** at its junction with **C48,** instead of directly to **V2** oscillator control grid. **R10** becomes 15,000 Ω instead of 35,000 Ω, and **C21** becomes 0.05 μF instead of 0.02 μF, but otherwise, except for a few alternative values such as 100,000 Ω for 99,000 Ω, or 0.00006 μF instead of 0.00005 μF which may be found in some chassis, the circuit and chassis are the same in both models.

Model A638ARG

In the main, this follows the design of the C638 with the modifications just described for the CA638 and one or two additional items. It is a radiogram with an automatic record changer.

A potential divider, consisting of a 2,000 Ω and a 1,000 Ω resistor, is shunted across **T1** secondary, the 1,000 Ω resistor going to the side connected to chassis. **V4** cathode is taken to the junction of the two resistors, and a 0.1 μF condenser goes from that point to chassis, introducing negative feed-back. The diode load resistor **R13** is returned to **V4** cathode.

The pick-up circuit is the same as in the other two models except for the introduction of an RC filter in the input circuit. This consists of a 490,000 Ω resistor shunted across the pick-up sockets, then a second 490,000 Ω series resistor between the high potential socket and **S18** followed by a 0.000765 μF condenser between **S18** and chassis. The bass compensator **C21** is omitted, **R14** going straight down to chassis.

The A638ARG must not be confused with the A638BG, which is very different in many ways, including the intermediate frequency which is 451 kc/s, from the three foregoing models. The chassis lay-out generally is very much like that of the other models, but it may be identified by the fact that **V5** and **V6,** according to the makers' manual, are transposed, and that only two electrolytic condensers are mounted on the chassis deck, a vacant hole being visible in the position which we show as being occupied by **C31.**

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