NUMBER 156

'TRADER' SERVICE SHEETS

PHILIPS 213U

3-VALVE A.C./D.C. RECEIVER

A VARIABLE-MU pentode H.F. amplifier, a pentode detector and a pentode output valve are employed in the Philips 213U 3-valve (plus rectifier) A.C./D.C. receiver. It is suitable for mains of 200-250 V (40-100 c.p.s. in the case of A.C.).

CIRCUIT DESCRIPTION

Alternative aerial input connections **A1** and **A2** (with series resistance **R1**) via series condenser **C1** and Droitwich rejector **L1, C22** (short-circuited on M.W. and normal L.W. by switch **S1**) to coupling coils **L2, L3.** Single-tuned circuit **L4, L5, C25** precedes variable-mu pentode H.F. amplifier (**V1, Mullard metallised VP13C**) operating with gain control by variable potentiometer **R8** which varies G.B. applied.

Tuned-secondary transformer coupling by **L6, L7, L8, L9** and **C28** to H.F. pentode detector (**V2, Mullard metallised SP13C**) which operates on grid leak system with **C10** and **R10, R11.** No reaction. H.F. by-passing in anode circuit by condenser **C14.**

D.C. potential developed across **R11** section of **V2** grid leak is fed back through decoupling circuit **R6, C7** as G.B. to H.F. amplifier, giving a simple form of automatic volume control.

Resistance-capacity coupling by **R14, C13,** and **R15** between **V2** and output pentode (**V3, Mullard Pen36C**). H.F filtering in C.G. circuit by **R16, C15, R17, C16** and **R18.** Tone correction by fixed condenser **C17** in anode circuit.

Provision for connection of high-impedance external speaker across special secondary winding on internal speaker transformer **T1.**

When the receiver is used with A.C. mains, H.T. current is supplied by half-wave rectifying valve (**V4, Philips CY1C**), which, with D.C. supplies, behaves as a low resistance. Smoothing by iron-cored choke **L11** and electrolytic condensers **C19, C20.**

Valve heaters are connected in series together with scale lamps and automatic current regulating barretter (**Philips C1 or C1C**) across mains input circuit.

COMPONENTS AND VALUES

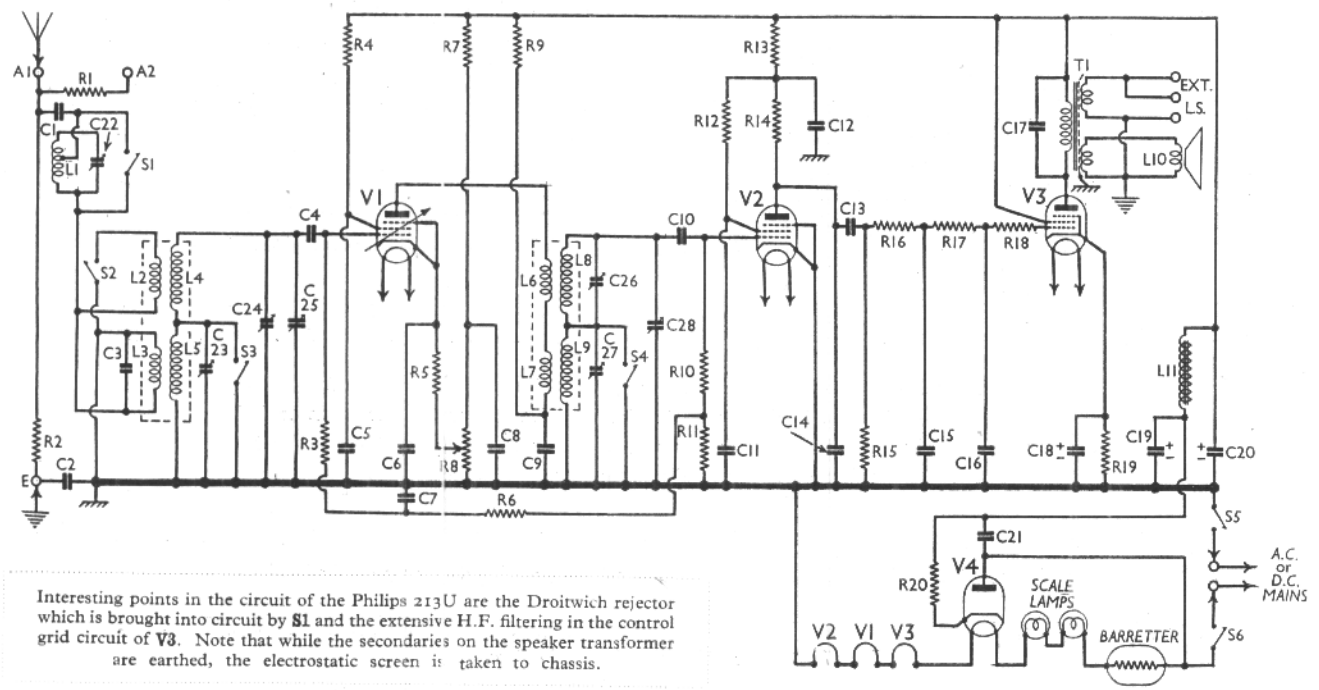
	RESISTANCES	Values (ohms)
R1	Aerial series resistance	200,000
R2	Aerial-earth shunt	100,000
R3	V1 C.G. resistance	1,350,000
R4	V1 S.G. H.T. feed	32,000
R5	V1 fixed G.B. resistance	200
R6	A.V.C. line decoupling	800,000
R7	Part gain control circuit	*32,000
R8	V1 gain control	12,500
R9	V1 anode decoupling	1,000
R10	V2 grid leak	1,250,000
R11		640,000
R12	V2 S.G. H.T. feed	800,000
R13	V2 S.G. and anode decoupling	20,000
R14	V2 anode load	320,000
R15	V3 C.G. resistance	500,000
R16	V3 C.G. H.F. stoppers	50,000
R17		50,000
R18		1,000
R19	V3 G.B. resistance	200
R20	H.T. supply ballast	200

* Two 64,000 Ω resistances in parallel.

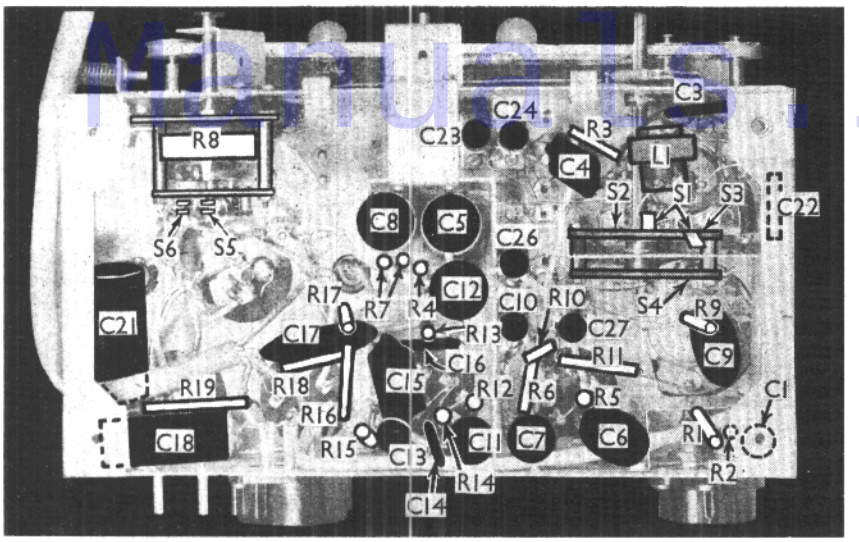
	CONDENSERS	Values (μF)
C1	Aerial series condenser	0·001
C2	Earth blocking condenser	0·1
C3	Aerial L.W. coupling trimmer	0·00008
C4	V1 C.G. condenser	0·000064
C5	V1 S.G. by-pass	0·5
C6	V1 cathode by-pass	0·1
C7	A.V.C. line decoupling	0·1
C8	Gain control by-pass	0·5
C9	V1 anode decoupling	0·1
C10	V2 C.G. condenser	0·000025
C11	V2 S.G. by-pass	0·1
C12	V2 anode and S.G. decoupling	0·5
C13	V2 to V3 L.F. coupling	0·02
C14	V2 anode H.F. by-pass	0·000125
C15	V3 C.G. H.F. by-passes	0·0001
C16		0·0001
C17	Tone corrector	0·004
C18*	V3 cathode by-pass	25·0
C19*	H.T. smoothing	32·0
C20*		32·0
C21	V4 anode-cathode by-pass	0·1
C22‡	Droitwich rejector tuning	0·00016
C23‡	Aerial circuit L.W. trimmer	0·000027
C24‡	Aerial circuit M.W. trimmer	0·000027
C25†	Aerial circuit tuning	0·00045
C26‡	H.F. trans. M.W. trimmer	0·000027
C27‡	H.F. trans. L.W. trimmer	0·000027
C28†	H.F. trans. tuning	0·00045

* Electrolytic † Variable ‡ Pre-set

	OTHER COMPONENTS	Approx. Values (ohms)
L1	Droitwich rejector coil, total	40·5
L2	Aerial coupling coils	110·0
L3		110·0
L4	Aerial circuit tuning coils	2·0
L5		30·0
L6	H.F. transformer primary	10·5
L7		60·0
L8	H.F. transformer secondary	2·4
L9		27·0
L10	Speaker speech coil	5·0
L11	H.T. smoothing choke	700·0
T1	Speaker input trans. Pri.	250·0
	Sec. (int.)	0·8
	Sec. (ext.)	1,100·0
S1-S4	Waveband switches	—
S5,S6	Mains switches (ganged R8)	—



Interesting points in the circuit of the Philips 213U are the Droitwich rejector which is brought into circuit by **S1** and the extensive H.F. filtering in the control grid circuit of **V3**. Note that while the secondaries on the speaker transformer are earthed, the electrostatic screen is taken to chassis.



View of underside of the chassis, with the screening plate removed.

DISMANTLING THE SET

Removing Chassis.—To remove the chassis from the cabinet, remove the three control knobs (recessed grub screws) and the four bolts (with washers) holding the chassis to the bottom of the cabinet. The chassis can now be withdrawn to the extent of the speaker leads, which is sufficient for normal purposes. Care should be taken to ensure that the stud on the drive belt disengages from the carriage of the dial pointer.

Before access can be gained to the under-chassis components, the screen must be removed (two screws).

When replacing, set the condenser and pointer at minimum when the stud in the drive belt can be made to engage with the cursor carriage without trouble.

To free the chassis entirely, remove the speaker transformer from the sub-baffle (two round-head wood screws) so that the connections are accessible and unsolder the leads. *When replacing*, connect the leads as follow, numbering the contact studs from the sub-baffle outwards:—Top: 1, lead painted black; 2, lead painted green. Bottom: 1, lead painted red (which continues as an earthing lead to the speaker and transformer frames); 2, yellow rubber-covered screened lead; 3, thin tinned copper lead in yellow insulating sleeving.

Removing Speaker.—To remove the speaker from the cabinet, unsolder the leads from the transformer secondary and frame, and slacken the three clamps (nuts, lock nuts and washers) holding it to the sub-baffle.

VALVE ANALYSIS

Valve voltages and currents given in the table below are those measured in our receiver when it was operating on A.C. mains of 220 V. The volume control was at maximum but there was no signal input.

Voltages were measured on the 1,200 V scale of an Avometer, chassis being negative.

Valve	Anode Voltage (V)	Anode Current (mA)	Screen Voltage (V)	Screen Current (mA)
V1, VP13C	192	5·9	130	2·1
V2, SP13C	25	0·5	34	0·2
V3 Pen36C	195	37·0	202	8·5
V4 CY1C†	—	—	—	—

† Cathode to chassis, 232 V D.C.

GENERAL NOTES

Switches.—**S1-S4** are in two rotary units, **S1-S3** being on the unit nearer to the control knob, and **S4** on the other unit. In the **S1-S3** unit, looking at the underside of the chassis, from the rear, **S1** is at the top, **S2** at the bottom and **S3** on the right. The table below gives the switch positions for the three control settings, O indicating open, and C closed.

Switch	M.W.	L.W. (Normal)	L.W. (Droitwich Filter)
S1	C	C	O
S2	C	O	O
S3	C	O	O
S4	C	O	O

S5 and **S6** are the Q.M.B. mains switches, ganged with the gain control, **R8.**

Coils.—**L1,** the Droitwich rejector coil, is beneath the chassis. **L2-L5** and **L6-L9** are in two screened units on the chassis deck.

Scale Lamps.—These are two Philips 10 V 0·2 A centre contact S.B.C. types.

External Speaker.—There are three sockets in a bakelite shield at the rear of the chassis for the connection of a high impedance external speaker, which operates from a high impedance secondary on **T1.** The centre socket of the three may be neglected.

Speaker Transformer.—Note that this has two secondaries, one of low impedance feeding the internal speaker speech coil, and another of high impedance for an external speaker. In all there are seven connections to soldering studs on the unit, two for the primary, two each for the two secondaries, and one for the electrostatic screen. This is connected to chassis, whereas one side of the external speaker secondary and the core of the transformer (and speaker chassis) are connected to true earth.

Condenser C10.—Although this is of the same type as the pre-set condensers, its value is fixed.

Chassis Divergency.—In some chassis a resistance of 200 O may be included in **V3** aux. grid H.T. feed circuit.

CIRCUIT ALIGNMENT

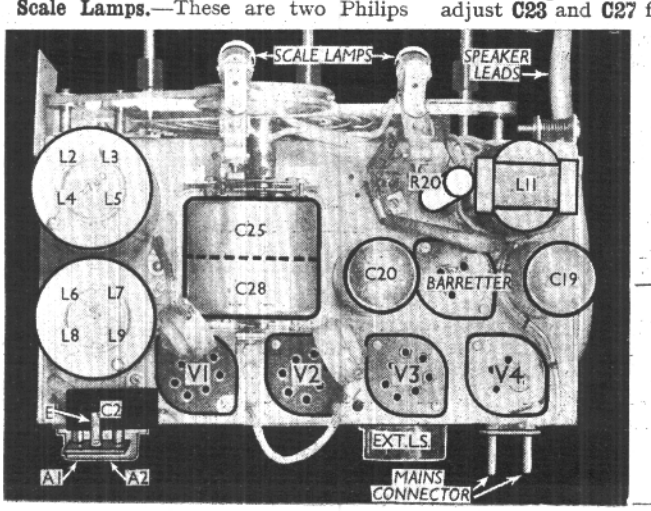
For alignment, connect an artificial aerial of 200 $\mu\mu$F to the **A1** aerial socket, and an output meter to the external L.S. sockets. An auxiliary scale must also be fitted. Open **C24** and **C26** as far as possible. Switch the set to M.W. Adjust the grid bias of **V1** to 3·0 V with the aid of the gain control, using a low consumption D.C. voltmeter connected between the cathode of **V1** and chassis.

Move the sliding electrodes of **C24** and **C26** to approximately 5·3 and 3·9 m.m. respectively from the top of the insulating core.

Tune set to 500 m. for maximum output, and adjust pointer to the 500 m. mark. Tune receiver to a 200 m. signal, and note if pointer covers 200 m. mark. If it does, adjust **C24** and **C26** for maximum output. If not, re-adjust tuning condenser to place the pointer half way to the other side of the 200 m. mark. Then adjust **C24** and **C26** for maximum output, and adjust the pointer accurately to the 200 m. mark by means of the driving band adjusting screw.

Tune to 225 m. Switch set to L.W., and leaving condenser setting unchanged, adjust **C23** and **C27** for maximum output on 900 m. Check calibration at 200, 500, 900 and 1,500 m.

To adjust Droitwich rejector, turn to third position of wavechange switch, feed in a 1,500 m. signal, and adjust **C22** for *minimum* output.



The smoothing choke (**L11**) is mounted on the chassis deck as shown by this plan view.