

# BUSH DAC 21 AND DUG 21 A.C./D.C. SUPERHETS

FOR rectification of A.C. mains a Westinghouse metal rectifier is used in the Bush DAC21 A.C./D.C. superhet. Its receiving circuit uses three valves and a Westector, and includes provision for an extension speaker, a plug and socket device allowing the speaker in the set to be cut out of circuit. It is for use on mains of 180-260 V.

A similar chassis is fitted in the DUG21 console receiver.

## CIRCUIT DESCRIPTION

Aerial input via isolating condenser C1 and coupling coils L1, L2 to inductively coupled band-pass filter. Primary L3, L4 tuned by C23; secondary L5, L6 tuned by C24; coupling coils L8, L9. Image suppression by coil L5 and condenser C2.

First valve (V1, Mullard metallised VP13C), is an octode operating as frequency changer with electron coupling. Oscillator grid coils L10, L11 tuned by C28, tracking by shaped plates and C29, C31 (L.W.); anode reaction coils L12, L13.

Second valve, a variable-mu H.F. pentode (V2, Mullard metallised VP13C), operates as intermediate frequency amplifier with tuned-primary, tuned-secondary transformer couplings C32, L14, L15, C33 and C34, L16, L17, C35.

Intermediate frequency 123 KC/S. Second detector forms part of metal rectifier (MR1, Westinghouse WMX12). Audio frequency component in rectified output is developed across manual volume control R15 and passed via coupling condenser C15 and I.F. stopper R17 to C.G. of pentode output valve (V3, Mazda Pen 3520). Fixed tone correction by condenser C17; two-point tone control by switch S6 and R.C. filter R19, C18. Provision for connection of low-impedance external speaker across secondary of internal speaker transformer T1. Plug and socket arrangement enables internal speaker speech coil circuit to be broken.

Second section of metal rectifier MR1 provides D.C. potential which is developed across resistance R13 and fed back via decoupling circuits as G.B. to F.C.

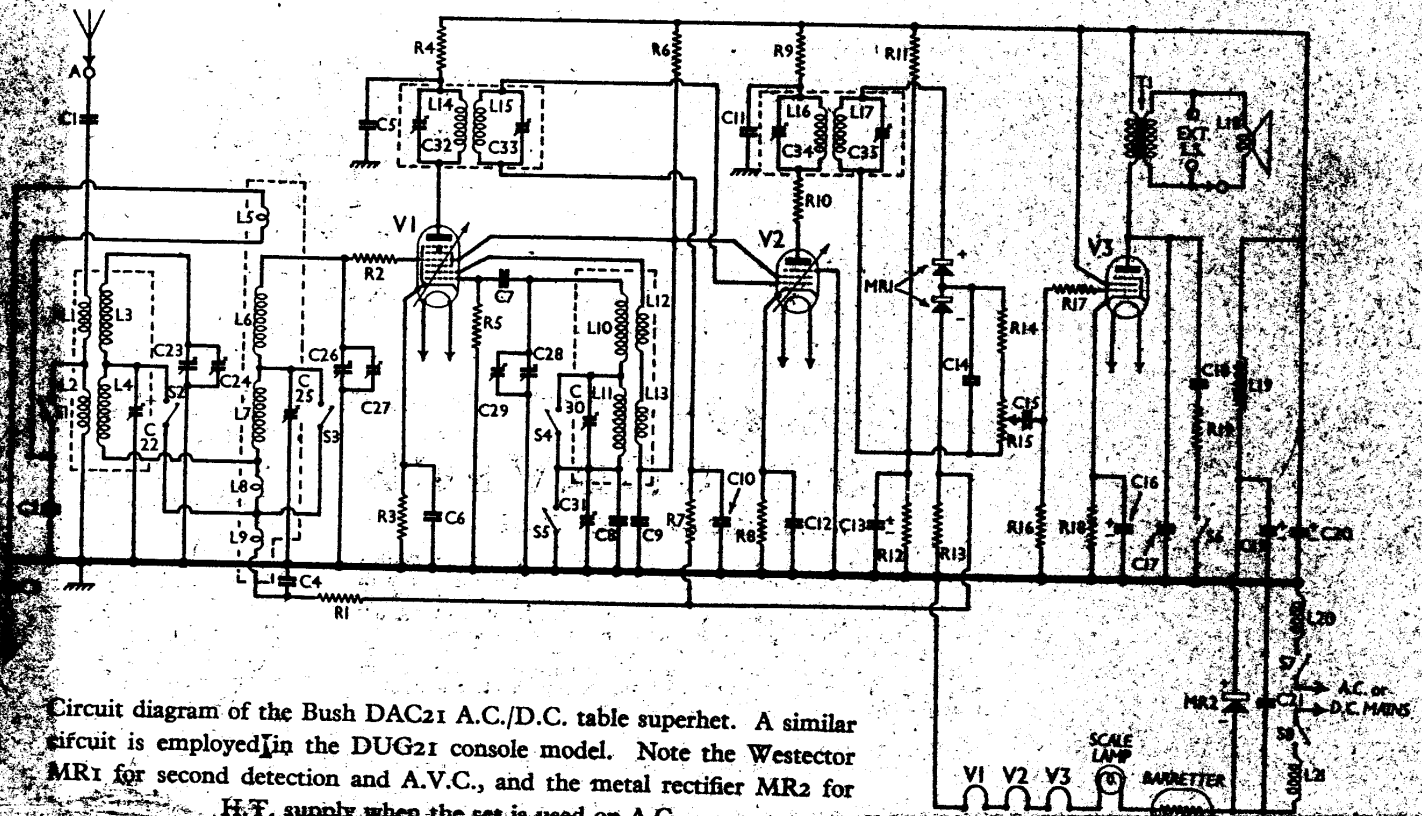
and I.F. valves, giving automatic volume control. Delay voltage is obtained from H.T. potential divider R11, R12.

When the receiver is used with A.C. mains, H.T. current is supplied by a half-wave metal rectifier (MR2, Westinghouse B27) which, with D.C. supplies, behaves as a low resistance. Smoothing is effected by iron-cored choke L19 and dry electrolytic condensers C19, C20.

Valve heaters are connected in series together with scale lamp and current regulating barretter lamp (Philips G1), across mains input circuit. Filter comprising chokes L20, L21 and condenser C21 suppresses mains-borne interference.

## COMPONENTS AND VALUES

RESISTANCES		Values (ohms)
R1	V1 pentode C.G. decoupling	1,000,000
R2	V2 pentode C.G. stabiliser	250
R3	V1 fixed G.B. resistance	250
R4	V1 pent. anode decoupling	10,000
R5	V1 osc. grid resistance	10,000
R6	V1, V2 S.G.'s and ecc. anode decoupling	20,000
R7	V2 C.G. decoupling	1,000,000
R8	V2 fixed G.B. resistance	1,000
R9	V2 anode decoupling	10,000
R10	V2 anode circuit stabiliser	10,000
R11	A.V.C. delay voltage potentiometer	100,000
R12	A.V.C. rectifier load	1,000,000
R13	I.F. stopper	50,000
R14	Manual volume control	500,000
R15	V3 C.G. resistance	500,000
R16	V3 C.G. I.F. stopper	100,000
R17	V3 G.B. resistance	180
R18	Part of T.C. filter	100,000
R19		100,000



Circuit diagram of the Bush DAC21 A.C./D.C. table superhet. A similar circuit is employed in the DUG21 console model. Note the Westector MR1 for second detection and A.V.C., and the metal rectifier MR2 for H.F. supply when the set is used as A.C.

**Power Transformer (Continued)**

... which are adjustable through the partition carrying the coil...

... capacitors L14, L15 and ... screened units on ... They contain their ... each pair being ... nut and screw ... two gain filter chokes...

... This is an Osram 6.2 V ... type, wired in series with ... and the barretter.

... Two sockets are ... the rear of the chassis for a ... speaker (2 Ω), ... a plug and socket ... the speech coil ... when required. ... the plug be re- ... the socket when the set is ... an external speaker is

... This is a Westing- ... double type, ... and A.V.C. ... when replacing at any ... (black) end goes to

... a half-wave Westinghouse ... (27 fins). The negative ... goes to L21.

... C4, C5, C6, C10, C11, C12.— ... six 0.1 μF paper types in a ... unit beneath the ... The metal case forms one ... for each condenser.

... C19, C20.—These are two

dry electrolytics in a single block beneath the chassis. The black lead is the common negative, the red the positive of C19 (16 μF) and the yellow the positive of C20 (24 μF).

**CIRCUIT ALIGNMENT**

For best results a signal generator and output meter should be used, and for complete re-alignment it will be necessary to remove the chassis from the cabinet, leaving the speaker connected.

**I.F. Circuits.**—When aligning the intermediate frequency amplifier, the generator must be set at 123 KC/S. The wave-change switch should be set at the M.W. position, and the tuning condenser should be at maximum capacity.

Connect the high potential lead of the signal generator to the control grid on the top of V1, and the earth lead to chassis.

Switch on the generator, keeping the input to the set very low, and adjust C25 (screw), C24 (nut), C33 (screw) and C32 (nut) for maximum output in each case, reducing the input as the circuits come into tune.

**H.F. and Oscillator Circuits.**—After checking the I.F. amplifier as above, set the signal generator to 300 m., and connect the leads to the aerial and earth terminals of the receiver. Set the wave-change switch to the M.W. position, and tune so that the pointer is at the 300 m. mark.

Now adjust C29 for maximum output. If there are two peaks, that produced with the least trimmer capacity is the correct one. Adjust C27 and C24, also for maximum output.

The calibration should now be correct over the whole of the M.W. band. For

L.W. re-alignment, set the receiver to L.W., with the tuning pointer at 1,000 m., and inject a 1,000 m. signal from the generator.

Adjust C30, C25 and C22 (beneath the chassis, through holes in the coil unit partition), for maximum output.

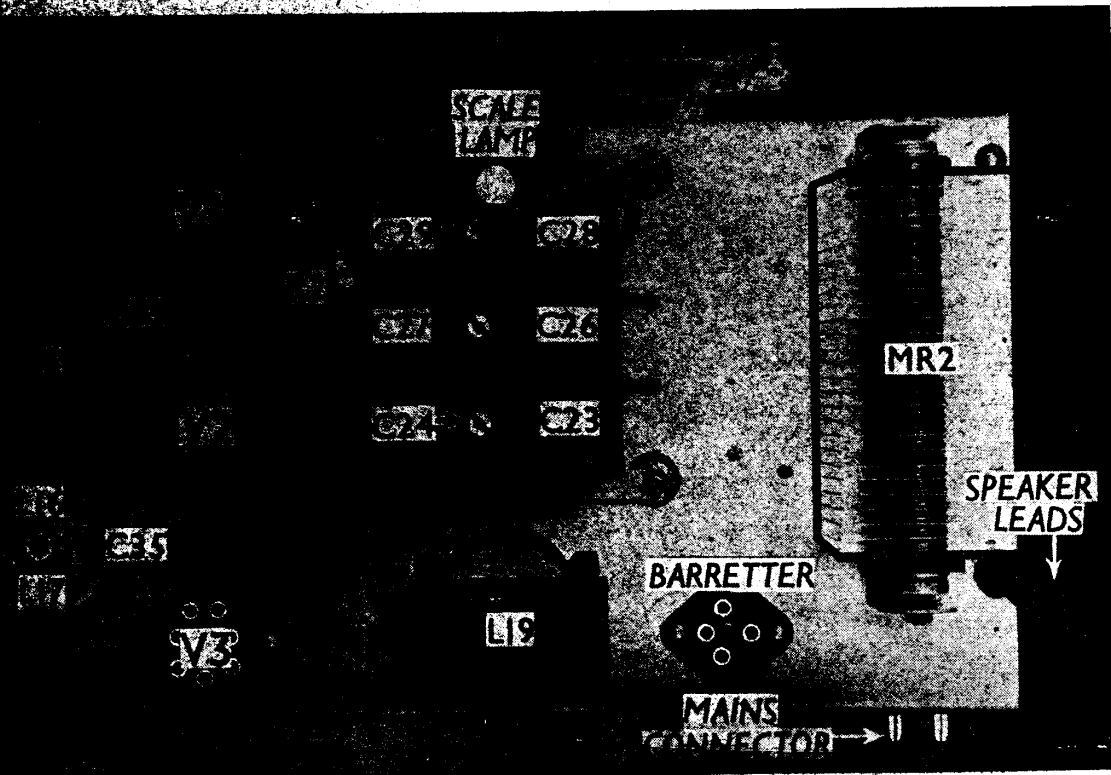
Now set the signal generator to 1,900 m., tune set to 1,900 m. on the scale, and adjust C31 (nut, at front of chassis). Finally check again at 1000 m.

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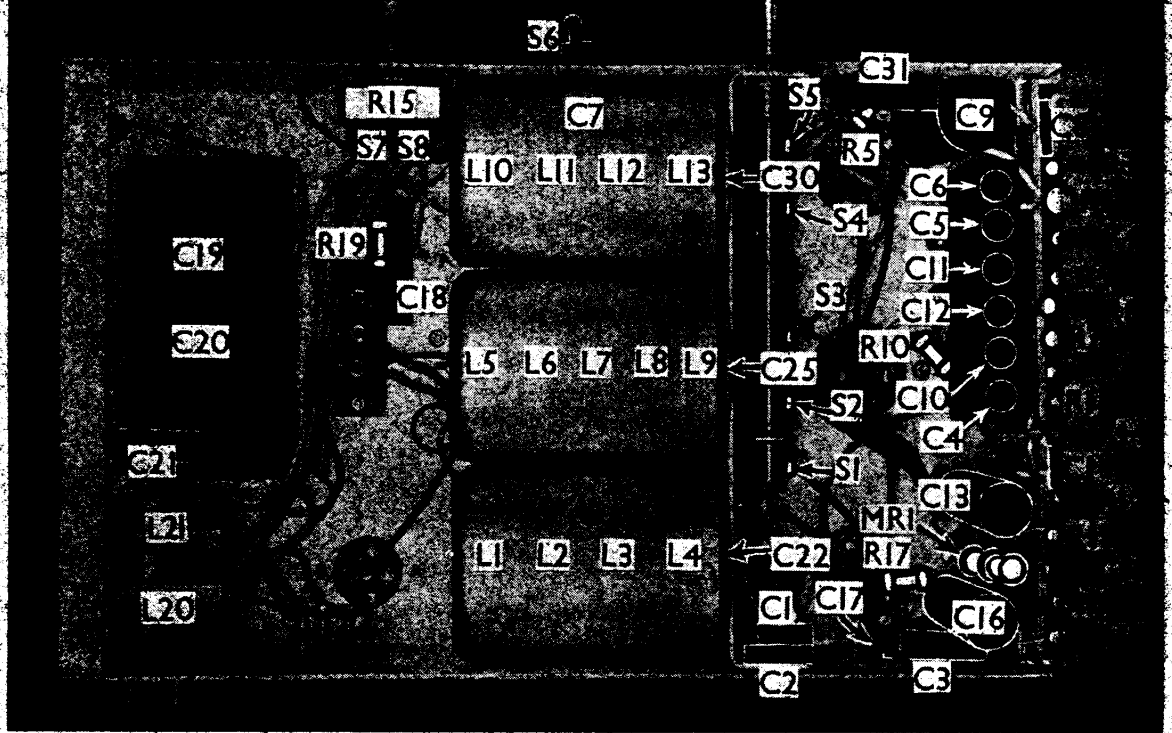
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Plan view of the chassis. The I.F. trimmers are adjusted by concentric nuts and screws as indicated by the arrows. MR2 is a metal rectifier for H.T. supply when the set is used on A.C.

Under-chassis view. C22, C25 and C30 are adjustable through holes in the partition carrying the coil units. The coupling of L5 in the middle unit can be adjusted by a nut and screw projecting through the top of the can. Note the Wavevector MR1 between C13 and C16.



CONDENSERS		Values (μF)
C1	Aerial blocking condenser	0.002
C2	Part image suppression circuit	0.01
C3	Earth blocking condenser	0.01
C4	V1 pentode C.G. decoupling	0.1
C5	V1 pent. anode decoupling	0.1
C6	V1 cathode by-pass	0.1
C7	V1 osc. C.G. condenser	0.0005
C8	Oscillator fixed L.W. tracker	0.0011
C9	V1, V2 S.G.'s and osc. anode decoupling	0.5
C10	V2 C.G. decoupling	0.1
C11	V2 anode decoupling	0.1
C12	V2 cathode by-pass	0.1
C13*	A.V.C. delay pot. by-pass	25.0
C14	I.F. by-pass	0.0001
C15	L.F. coupling to V3	0.01
C16*	V3 cathode by-pass	25.0
C17	Phase tone corrector	0.005
C18	Part T.C. filter	0.03
C19*	H.T. smoothing	16.0
C20*		24.0
C21	Mains H.F. by-pass	0.01
C22†	Band-pass pri. L.W. trimmer	—
C23†	Band-pass primary tuning	—
C24†	Band-pass pri. main trimmer	—
C25†	Band-pass sec. L.W. trimmer	—
C26†	Band-pass secondary tuning	—
C27†	Band-pass sec. main trimmer	—
C28†	Oscillator tuning	—
C29†	Oscillator main trimmer	—
C30†	Oscillator L.W. trimmer	—
C31†	Oscillator L.W. tracker	—
C32†	1st I.F. trans. pri. tuning	—
C33†	1st I.F. trans. sec. tuning	—
C34†	2nd I.F. trans. pri. tuning	—
C35†	2nd I.F. trans. sec. tuning	—

\* Electrolytic. † Variable. ‡ Pre-set.

OTHER COMPONENTS (Continued)		Approx. Values (ohms)
L12	Oscillator reaction coils (total)	3.5
L13		
L14		
L15	1st I.F. trans. { Pri. ...	110.0
L16		Sec. ...
L17	2nd I.F. trans. { Pri. ...	110.0
L18		Sec. ...
L19	Speaker speech coil	1.6
L20	H.T. smoothing choke	155.0
L21	Mains filter chokes	6.3
TR	Speaker input trans. { Pri. ...	750.0
	Sec. ...	0.35
MR1	Signal and A.V.C. rectifier	—
MR2	H.T. rectifier	—
S1-S5	Waveband switches	—
S6	Tone control switch	—
S7, S8	Mains circuit switches	—

### DISMANTLING THE SET

**Removing Chassis.**—To remove the chassis from the cabinet, first remove the back (four knurled head screws) and the three control knobs (recessed grub screws). Next remove the four bolts (with washers) holding the chassis to the bottom of the cabinet and free the speaker leads from the two cleats holding them to the side of the cabinet. The chassis can now be withdrawn to the extent of the speaker leads, which is sufficient for normal purposes.

To free the chassis entirely, unsolder the leads and when replacing, connect them as follows, numbering the tags from bottom to top: 1, red; 2, black; 3, green; 4, brown; 5, yellow.

**Removing Speaker.**—To remove the speaker from the cabinet, remove the nuts and washers from the four bolts with ornamental heads holding it to the cabinet front. When replacing, see that the transformer is on the right.

### VALVE ANALYSIS

Valve voltages and currents given in the table (Col. 3) are those measured in our receiver when it was operating on

A.C. mains of 230 V. The set was tuned to the lowest wavelength on the medium band and the volume control was at maximum, but there was no signal input.

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

Valve	Anode Volts	Anode Current (mA)	Screen Volts	Screen Current (mA)
V1 FC13C*	205	2.1	90	4.2
V2 VPr3C	175	2.3	90	0.8
V3 Pen3520	208	40.0	240	9.5

\* Osc. anode (G2) 95 V, 1.6 mA.

### GENERAL NOTES

**Switches.**—S1-S5 are the waveband switches, in a single unit beneath the chassis, seen in our under-chassis view. The switches are all closed on the M.W. band and open on the L.W. band.

S6 is the Q.M.B. tone control switch which is open when the knob is pushed to the right.

S7 and S8 form the double-pole Q.M.B. mains switch, ganged with the volume control R15.

**Coils.**—The signal frequency and oscillator coils, L1-L13, are in three screened units beneath the chassis. L5, in the middle unit, is an image suppressor coil, and its coupling to the other coils in the unit is adjustable by means of the nut on a screw projecting through the top of the screen.

The L10-L13 unit also contains the fixed condenser C7. The screen of this unit cannot be removed until the volume control and mains switch unit is detached. This can be done without unsoldering any wiring.

The three coil units also contain the L.W. trimmers C22, C25 and C30

(Continued overleaf)

OTHER COMPONENTS		Approx. Values (ohms)	
L1	Aerial coupling coils	1.5	
L2			6.0
L3			3.0
L4	Band-pass primary coils	12.0	
L5	Image suppression coil	Very low	
L6	Band-pass secondary coils	3.0	
L7			12.0
L8	Band-pass coupling coil	3.5	
L9			0.5
L10	Oscillator tuning coils	3.5	
L11			8.5