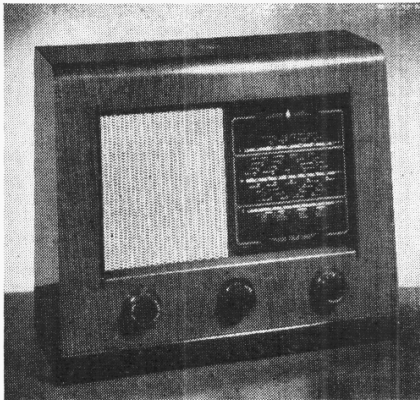


"TRADER" SERVICE SHEET

1066

BUSH AC31



THE use of the frequency changer oscillator as a pick-up pre-amplifier, and the inclusion of a delayed A.G.C. system, are features of the Bush AC31 receiver, a 3-valve (plus rectifier) 3-band superhet designed to operate from A.C. mains of 100-250 V, 40-100 c/s. A companion model designed for A.C./D.C. mains operation is covered in Service Sheet 1067. The waveband ranges are 14.3-35.5 m, 176-575 m and 1,000-2,000 m.

Release date and original price: April 1952; £16 1s 2d, plus purchase tax.

CIRCUIT DESCRIPTION

Aerial input via coupling coils L1 (S.W.) and L2 (L.W.) to single-tuned circuits L3, C27 (S.W.), L4, C27 (M.W.) and L5, C27 (L.W.). These precede triode hexode valve (V1, Mullard ECH42) which operates as frequency changer with in-

ternal coupling. Aerial coupling on M.W. is via a tapping on the tuning coil L4. Oscillator grid coils L6 (S.W.), L7 (M.W.) and L8 (L.W.) are tuned by C28. Parallel trimming by C29 (S.W.), C30 (M.W.) and C10, C12 (L.W.); series tracking by C9 (M.W.) and C11 (L.W.), although tracking adjustments are made by Iron-duct cores. Reaction coupling is via L9 on S.W. and L10 on M.W., but on L.W. it is derived from the common impedance of C11. Second valve (V2, Mullard EBF80) is a variable-mu R.F. pentode with two diodes. The (Continued col. 1 overleaf)

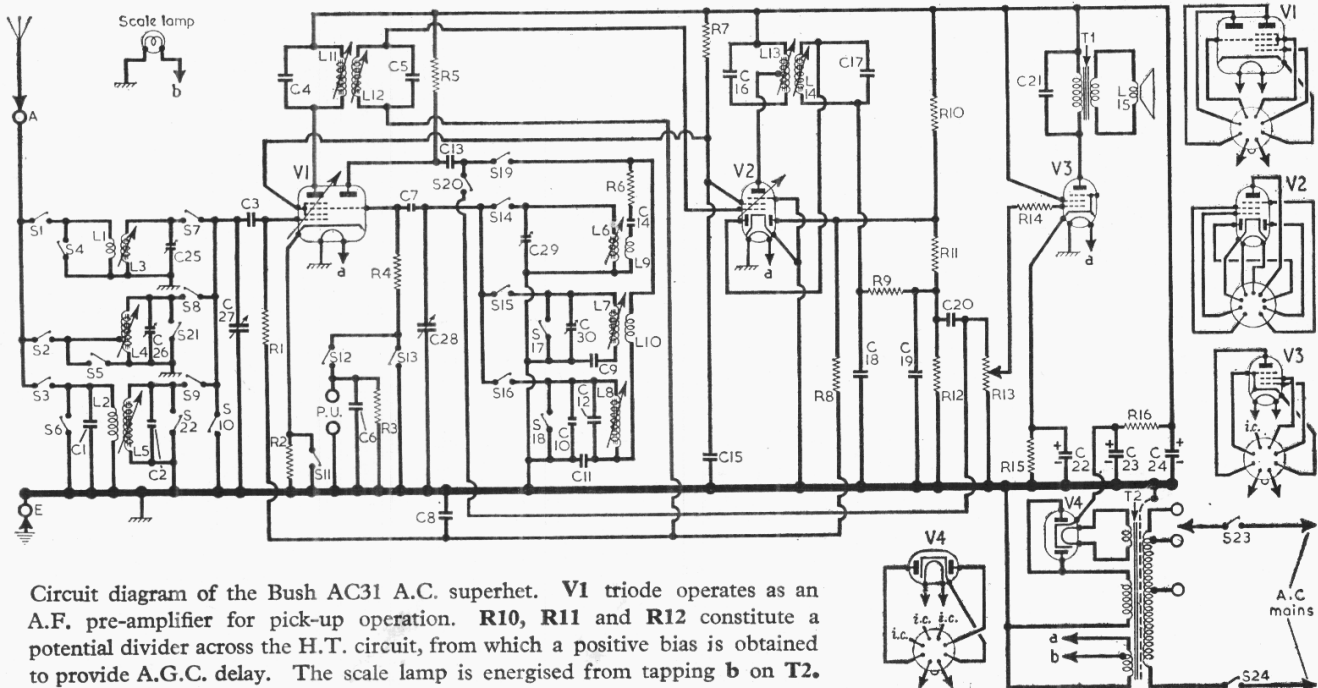
COMPONENTS AND VALUES

CAPACITORS		Values	Locations
C1	L.W. aerial shunt...	600pF	G4
C2	L.W. aerial trim...	85pF	G4
C3	V1 C.G.	100pF	F4
C4	1st I.F. trans. tuning	110pF	A2
C5		110pF	A2
C6	P.U. tone corrector	0.002µF	G4
C7	V1 osc. C.G.	56pF	G3
C8	A.G.C. decoupling	0.05µF	F4
C9	M.W. osc. tracker...	515pF	G3
C10	L.W. osc. trim...	33pF	G3
C11	L.W. osc. tracker...	365pF	G3
C12	L.W. osc. trim...	240pF	G3
C13	Oscillator couplers	0.001µF	F3
C14		56pF	G3
C15	S.G. decoupling ...	0.05µF	F4
C16	2nd I.F. trans. tuning	110pF	B2
C17		110pF	B2
C18	L.F. by-passes ...	100pF	F4
C19	L.F. by-passes ...	100pF	E4
C20		0.002µF	E4
C21	Tone corrector ...	0.01µF	D3
C22*	V3 cath. by-pass ...	50µF	E3
C23*	H.T. smoothing ...	32µF	B1
C24*		32µF	B1
C25†	S.W. aerial trim...	120pF	G3
C26†	M.W. aerial trim...	40pF	G3
C27†	Aerial tuning ...	528pF	A2
C28†	Oscillator tuning ...	528pF	A1
C29†	S.W. osc. trim...	120pF	G3
C30†	M.W. osc. trim...	40pF	G3

RESISTORS		Values	Locations
R1	V1 C.G. ...	680kΩ	F4
R2	V1 G.B. ...	380Ω	G4
R3	P.U. shunt ...	680kΩ	G4
R4	V1 osc. C.G. ...	47kΩ	G3
R5	Osc. anode feed ...	10kΩ	F3
R6	Osc. stabilizer ...	100Ω	F3
R7	S.G. H.T. feed ...	39kΩ	F3
R8	A.G.C. decoupling	1.5MΩ	F4
R9	I.F. stopper ...	47kΩ	F4
R10	Part A.G.C. delay	20MΩ	F3
R11		bias pot.	680kΩ
R12	Diode load ...	330kΩ	E4
R13	Volume control ...	500kΩ	D3
R14	V3 C.G. stopper ...	47kΩ	E3
R15	V3 G.B. ...	180Ω	E3
R16	H.T. smoothing ...	1.5kΩ	E4

OTHER COMPONENTS		Approx. Values (ohms)	Locations
L1	Aerial coupling coils	0.5	G4
L2		50.0	G4
L3		—	G4
L4	Aerial tuning coils	7.0	G4
L5		20.0	G4
L6	Osc. tuning coils ...	5.0	G3
L7		—	G3
L8	Osc. reaction coils	5.0	G3
L9		0.5	G3
L10	1st I.F. trans.	1.0	G3
L11		Pri. 12.5	A2
L12	Sec. 12.5	A2	
L13	2nd I.F. trans. total	12.5	B2
L14	Speech coil	2.3	—
L15		—	—
T1	O.P. trans. Pri. ...	410.0	—
T2	Mains trans.	Pri. total 45.0	C2
		H.T. sec. 140.0	
		Rect. htr. 0.9	
S1-S22	Waveband switches	Htr. sec. total 0.4	G3
		—	
S23, S24	Mains sw., g'd R13	—	D3

* Electrolytic. † Variable. ‡ Pre-set.



Circuit diagram of the Bush AC31 A.C. superhet. V1 triode operates as an A.F. pre-amplifier for pick-up operation. R10, R11 and R12 constitute a potential divider across the H.T. circuit, from which a positive bias is obtained to provide A.G.C. delay. The scale lamp is energised from tapping b on T2.

Circuit Description—continued

pentode operates as intermediate frequency amplifier with tuned transformer couplings C4, L11, L12, C5 and C16, L13, L14, C17.

Intermediate frequency 470 kc/s. One of the diodes of V2 operates as signal detector, and the audio frequency component in the rectified output is developed across load resistor R12. It passes via C20, manual volume control R13 and grid stopper R14 to control grid of pentode output valve (V3, Mullard EL41). I.F. filtering by C18, R9, C19. For operation with a gramophone pick-up, the triode section of V1 acts as an A.F. pre-amplifier. The pick-up input, which is shunted by C6, R3, is connected via S12 to the triode grid, and the amplified output developed across R5 is connected via C13 and S20 to the top of R13, and handed on to the output valve. S11 opens for gram, applying G.B. to V1 triode.

The D.C. potential developed across R12 is fed back via R11 and decoupling circuits to F.C. and I.F. valves, giving automatic gain control, but its action is delayed. R10, R11 and R12 form an H.T. potential divider from which a positive potential is applied to the second diode of V2, maintaining it in a conductive condition in the absence of a signal and thus holding the A.G.C. line down to cathode (chassis) potential.

When the signal strength rises sufficiently, the negative D.C. potential developed across R12 neutralizes the positive bias on the diode, and it ceases to conduct. After that the diode potential becomes more negative with increased signal strength and carries with it the A.G.C. line, via R8.

H.T. current is supplied by an I.H.C. rectifying valve (V4, Mullard EZ40), whose anodes are strapped to operate as a half-wave rectifier. Smoothing is effected by R16 and electrolytic capacitors C23, C24. The scale lamp is energized from a tapping on the heater winding of the double-wound mains transformer T2.

VALVE ANALYSIS

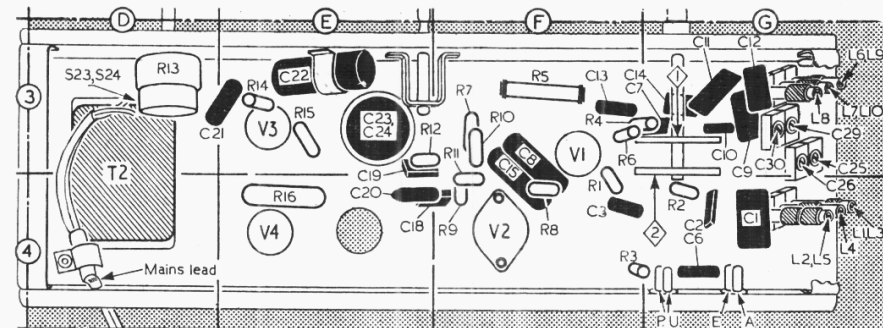
Valve voltages and currents given in the table below are derived from the makers' service manual. Their receivers were operating from mains of 230 V, 50 c/s, and were switched to the M.W. band, but there was no signal input. H.T. voltages were measured in the 1,000 V range of a Model 7 Avometer, but for V4 cathode voltage the 10 V range was used. Chassis was the negative connection in all cases.

Valves	Anode		Screen		Cath.
	V	mA	V	mA	
V1 ECH42	230 120	2.0 5.0	60	3.0	—
V2 EBF80	230	4.0	60	1.5	—
V3 EL41	220	32.0	230	5.0	6.8
V4 EZ40	300†	—	—	—	*

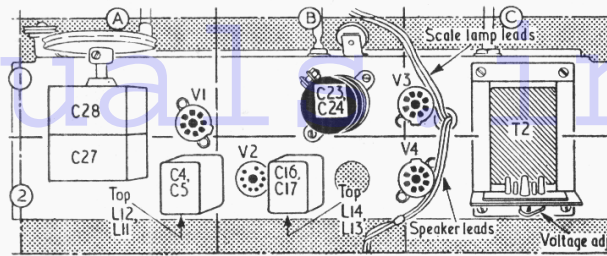
† Each anode, A.C. * Cathode current 53mA.

GENERAL NOTES

Switches.—S1-S22 are the waveband and radio/gram change-over switches, ganged in two rotary units beneath the chassis. These are indicated in our underside view of the chassis, and shown in detail in the diagrams inset beside the plan view drawing, where they are viewed in the directions of the arrows in the underside drawing.



Underside view of the chassis. 1 and 2 in diamonds indicate waveband switch units.



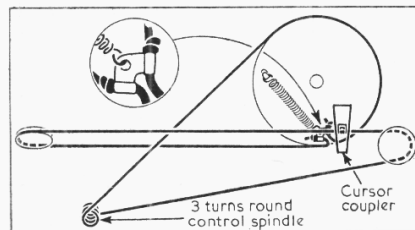
ing. The table below the diagrams gives the switch positions for the four control settings, starting from the fully anti-clockwise position of the control knob. A dash indicates open, and C, closed.

Scale Lamp.—This has a large clear spherical bulb and an M.E.S. base, and is rated at 6.2 V, 0.3 A.

Gram P.U.—The makers recommend a pick-up of the crystal type, although a magnetic pick-up can be used. They suggest an Acos type GP19. The lower P.U. socket is earthed.

Drive Cord Replacement.—Forty inches of nylon braided glass yarn is required for a new tuning drive cord, this length allowing plenty for tying off. The cord should be run as shown in the accompanying sketch, where it is drawn as seen from the front of the chassis. The pointer coupler can be fitted afterwards, but its position must be adjusted as explained under "Circuit Alignment" with the chassis in the cabinet.

The cord is terminated at both ends in a small metal plate, and can be made up in ad-



Sketch of the drive cord system. The cord clamp is shown inset.

vance and fitted afterwards. The makers give the exact circular length of the cord after clamping its ends in the plate as 36 3/4 in.

CIRCUIT ALIGNMENT

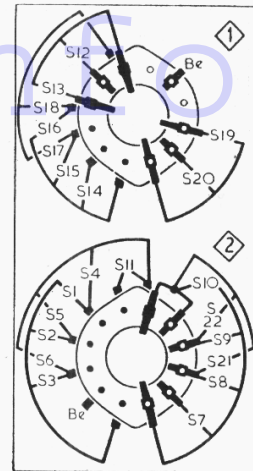
Remove chassis from cabinet and stand it in its normal position on the bench. All the I.F. adjustments are then accessible from the rear of the receiver, and the R.F. and oscillator adjustments from one end of it. Before commencing alignment, the receiver and the signal generator should be switched on and allowed to warm up for about ten minutes.

I.F. Stages.—Turn gang to maximum capacitance and connect output of signal generator via an 0.01µF capacitor in the "live" lead, to anode (pin 6) of V2 and chassis. Switch receiver to M.W., feed in a 470 kc/s (638.3 m) signal, and adjust the cores of L14 (location reference B2)

Above: Plan view of the chassis.

Right: Waveband switch diagrams.

Below: Waveband switch table.



Switches	S.W.	M.W.	L.W.	Gram.
S1	C	—	—	—
S2	—	C	—	—
S3	—	—	C	—
S4	—	C	—	—
S5	—	—	C	—
S6	—	—	—	C
S7	C	—	—	—
S8	—	C	—	—
S9	—	—	C	—
S10	—	C	—	C
S11	C	—	—	—
S12	—	C	—	C
S13	C	—	C	—
S14	—	C	—	—
S15	—	C	—	—
S16	—	—	C	—
S17	C	—	—	—
S18	—	C	—	—
S19	—	C	—	C
S20	—	—	—	C
S21	C	—	—	—
S22	C	C	—	—

and L13 (B2) for maximum output. Transfer signal generator "live" lead to control grid (pin 6) of V1, and adjust the cores of L12 (A2) and L11 (A2) for maximum output, decreasing the input as the circuits come into line to avoid A.G.C. action.

R.F. and Oscillator Stages.—As the tuning scale remains fixed to the cabinet when the chassis is withdrawn, reference is made in the following alignment to the substitute tuning scale fixed to the back of the tuning drive drum. This scale has the trimming and tracking points marked on it in wavelengths, and is read off against the top sloping edge of the thick metal pointer. Check that with the gang at maximum capacitance, the pointer coincides with the datum line on the substitute scale. When the chassis is finally replaced in its cabinet, check that with the gang at maximum capacitance, the cursor coincides with the two dots at the high-wavelength ends of the S.W. and L.W. tuning scales. A dummy aerial, consisting of a 200 pF capacitor should be connected in series with the "live" signal generator lead for M.W. and L.W., and a 400 Ω non-inductive resistor for S.W. Connect output of signal generator, via dummy aerial, to A and E sockets.

L.W.—Switch receiver to L.W., tune to 1,400 m on substitute scale, feed in a 1,400 m (214 kc/s) signal and adjust the cores of L8 (G3) and L5 (G4) for maximum output. Check calibration over band.

M.W.—Switch receiver to M.W., tune to 500 m, feed in a 500 m (600 kc/s) signal and adjust the cores of L7 (G3) and L4 (G4) for maximum output. Tune receiver to 200 m, feed in a 200 m (1,500 kc/s) signal and adjust C30 (G3) and C26 (G3) for maximum output. Repeat these adjustments until no further improvement results.

S.W.—Switch receiver to S.W., tune to 30 m, feed in a 30 m (10 Mc/s) signal and adjust the cores of L6 (G3) and L3 (G4) for maximum output. Tune receiver to 15 m, feed in a 15 m (20 Mc/s) signal and adjust C29 (G3) and C25 (G3) for maximum output. Repeat these adjustments until no further improvement results.