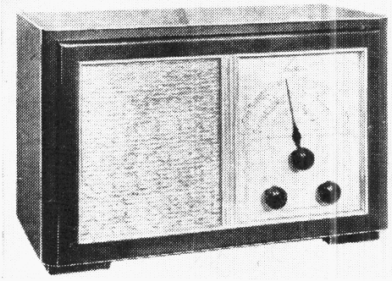
Supplement to The Wireless & Electrical Trader, November 30, 1946

"TRADER" SERVICE SHEET 794

BEETHOVEN A415

3-BAND A.C. SUPERHET



The appearance of the Beethoven A415 A.C. superhet. The complete front, including speaker and scale as seen here, is withdrawn forward to dismantle the set.

SPECIAL consideration has been given to the subject of accessibility, from the point of view of service work, in the Beethoven A415. The chassis and speaker are mounted on the front panel of the cabinet, and can be removed complete as a working unit. Metal stays permit the chassis to be turned over without damage.

The receiver is a 4-valve (plus rectifier) 3-band superhet with a band-pass input circuit on M.W. and L.W. bands. It is designed to operate from A.C. mains of 200-250 V. The S.W. range is 16-50 m.

Release date and original price: *May*, 1946; £16 16s, *plus* £3 12s 6d *purchase tax*.

CIRCUIT DESCRIPTION

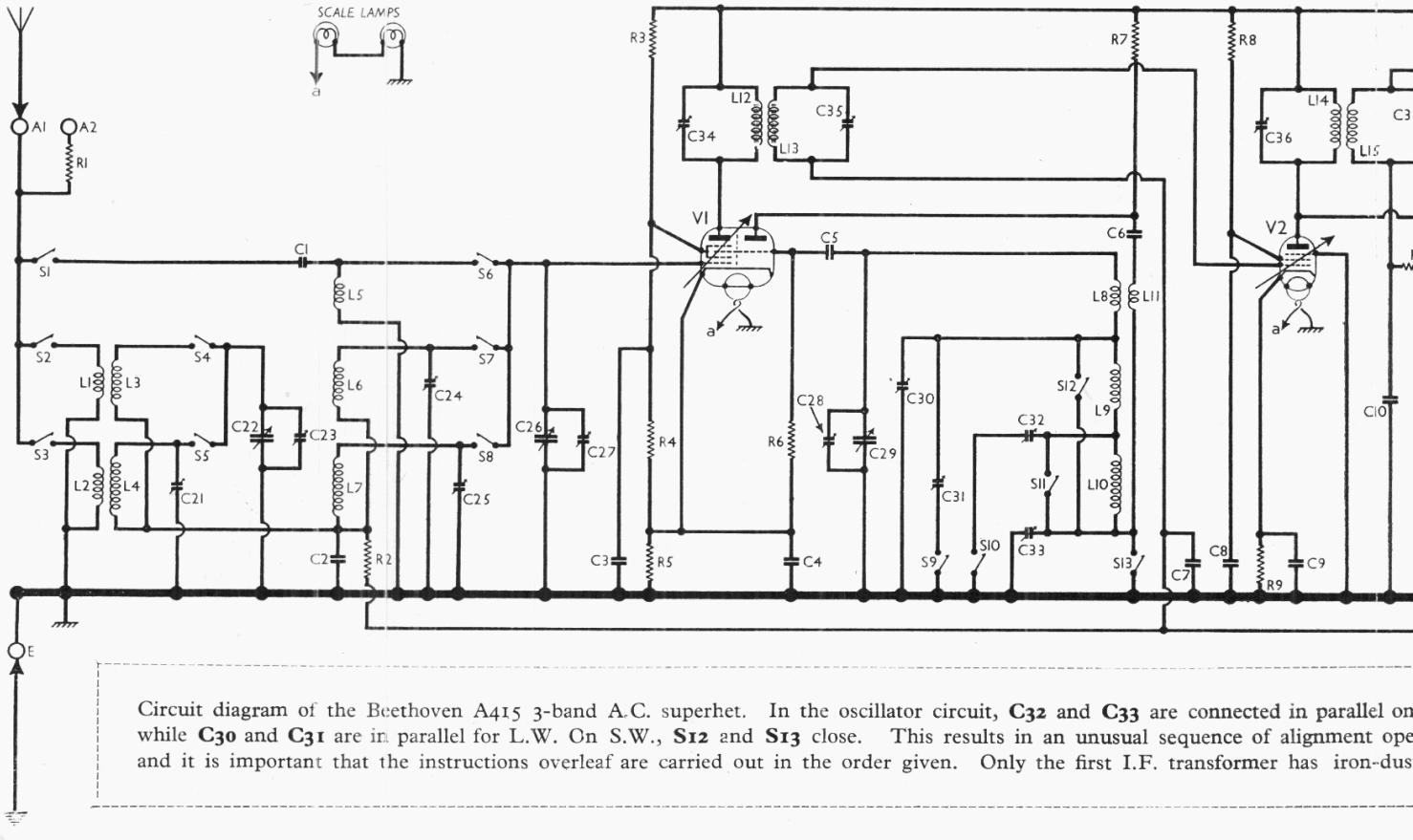
Two alternative aerial input sockets, **A1** and **A2**. On M.W. and L.W., input from **A1** is via coupling coils **L1** (M.W.) and **L2** (L.W.) to inductively coupled band-pass filter. Primary coils **L3** (M.W.) and **L4** (L.W.) are tuned by **C22**; secondary coils **L6** (M.W.) and **L7** (L.W.) are tuned by **C26.** Coupling by induction between primary and secondary windings.

On S.W., input from **A1** is via series capacitor **C1** to single tuned circuit **L5, C26.** From socket **A2,** input is fed via series resistor **R1** for the reception of strong transmissions.

First valve **(V1, Mullard metallized ECH35)** is a triode-hexode operating as frequency changer with internal coupling. Triode oscillator grid coils **L8** (S.W.), **L9** (M.W.) and **L10** (L.W.) are tuned by **C29.** Parallel trimming by **C28** (S.W.), **C30** (M.W.) and **C31,** when **S9** closes (L.W.).

Since **S12** and **S13** close on S.W., there are no trackers in circuit on that band; on M.W., **S10** and **S11** close, so that **C32** and **C33** operate in parallel as trackers on that band; on L.W., **S9** closes only, and **C33** is the tracker on that band. Reaction coupling from anode via **C6** is applied inductively on S.W. by **L11, S13** connecting the earthy end of it to chassis, but on M.W. and L.W., reaction coupling is derived from the common impedance of the trackers in grid and anode circuits.

Second valve **(V2, Mullard metallized EF39)** is a variable-mu R.F. pentode operating as intermediate frequency amplifier with tuned-primary, tuned-secondary transformer couplings **C34, L12, L13, C35** and **C36, L14, L15, C37.**



Circuit diagram of the Beethoven A415 3-band A.C. superhet. In the oscillator circuit, **C32** and **C33** are connected in parallel on while **C30** and **C31** are in parallel for L.W. On S.W., **S12** and **S13** close. This results in an unusual sequence of alignment ope and it is important that the instructions overleaf are carried out in the order given. Only the first I.F. transformer has iron-dus

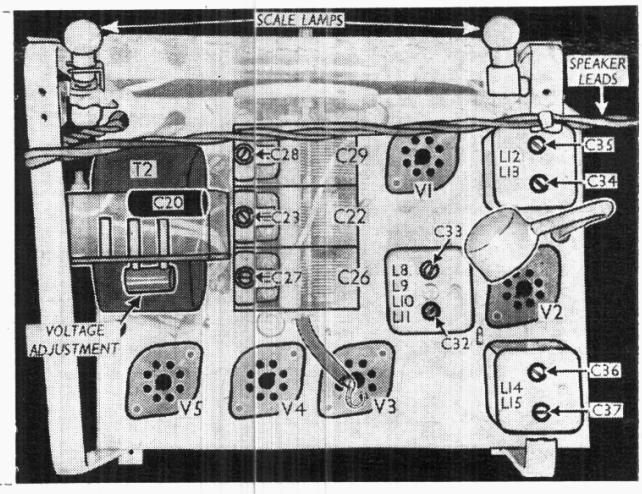
Intermediate frequency 450.5 kc/s.

Diode second detector is part of double diode triode valve **(V3, Mullard metallized EBC33).** Audio frequency component in rectified output is developed across manual volume control **R11,** which also acts as diode load resistor, and passed via A.F. coupling capacitor **C13** and C.G. resistor **R12** to C.G. of triode section, which operates as A.F. amplifier. Provision for connection of gramophone pick-up across **R11.** I.F. filtering by **C10, R10, C11** in diode circuit and **C15** in tricde anode circuit.

Second diode of **V3,** fed from **V2** anode via **C12,** provides D.C. potential which is developed across load resistor **R17** and fed back through decoupling circuits as G.B. to F.C. (except on S.W.) and I.F. valves, giving automatic volume control. Delay voltage, together with G.B. for triode section, is obtained from the drop along resistor **R13** in **V3** cathode lead to chassis.

Resistance-capacitance coupling by **R15, C16** and **R18,** via grid stopper **R19,** between **V3** triode and pentode output valve **(V4, Mullard EL33).** Fixed tone correction by **C17** in anode circuit, and provision for the connection of a low impedance external speaker across the secondary winding of the internal speaker input transformer **T1.**

H.T. current is supplied by a full-wave rectifying valve **(V4, Mullard AZ31).** Smoothing by resistor **R21** and electrolytic capacitors **C18** and **C19.** Mains R.F. filtering by **C20.**



Plain view of the chassis. The steel bars seen rising above the chassis permit it to be rolled over or stood on end without damage, providing easy accessibility. The trackers **C32, C33,** at the top of the **L8-LII** can, may be transposed in some cases. **C32** is coded red, and **C33** is coded blue.

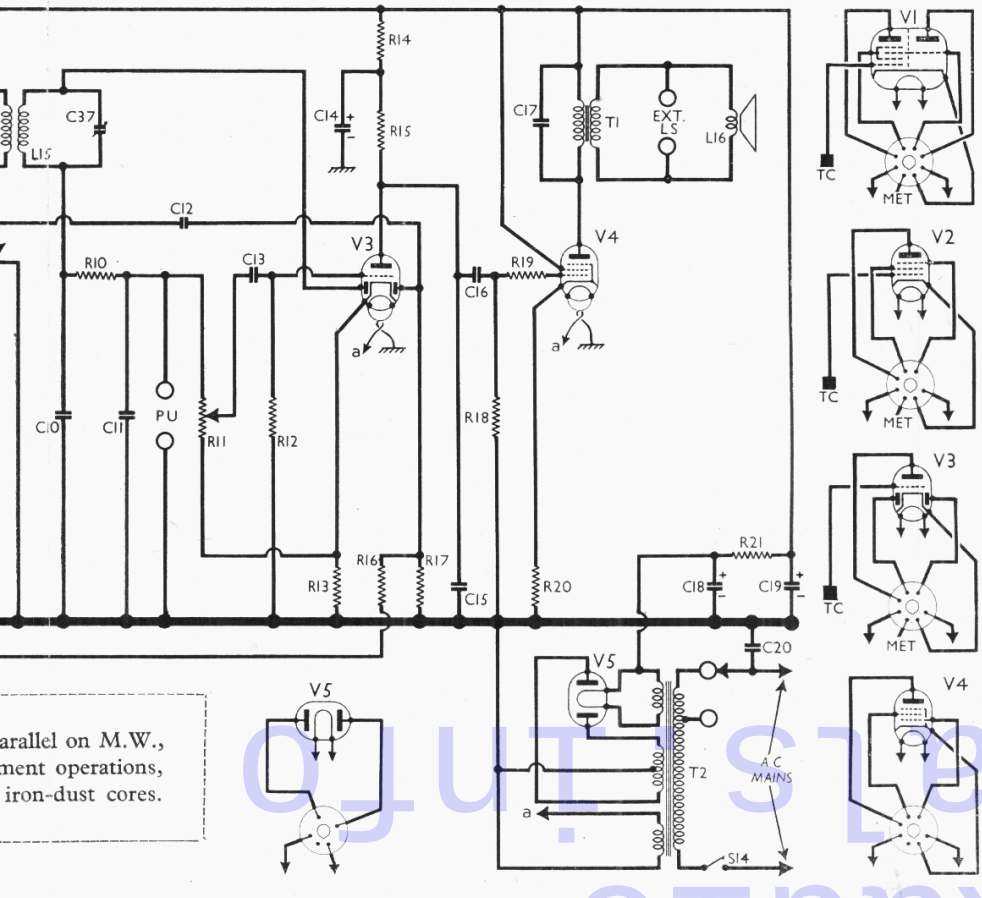
COMPONENTS AND VALUES

	CAPACITORS	Values (μF)
C1	Aerial S.W. coupling ...	0·00005
C2	V1 hex. C.G. decoupling...	0·1
C3	V1 S.G. decoupling ...	0·01
C4	V1 cathode by-pass ...	0·01
C5	V1 osc. C.G. capacitor ...	0·0001
C6	V1 osc. anode coupling ...	0·01
C7	V2 C.G. decoupling ...	0·1
C8	V2 S.G. decoupling ...	0·1

(*Continued next column*)

	CAPACITORS (*continued*)	Values (μF)
C9	V2 cathode by-pass ...	0·01
C10, C11	I.F. by-pass capacitors ...	0·00015, 0·00015
C12	V3 A.V.C. diode coupling	0·000005
C13	A.F. coupling to V3 triode	0·05
C14*	V3 anode decoupling ...	2·0
C15	V3 anode I.F. by-pass ...	0·0001
C16	A.F. coupling to V4 C.G....	0·05
C17	Fixed tone corrector ...	0·002
C18*, C19*	H.T. smoothing capacitors	16·0, 16·0
C20	Mains R.F. by-pass ...	0·01
C21‡	B.-P. pri. L.W. trimmer...	—
C22†	Band-pass pri. tuning ...	—
C23‡	B.-P. pri. M.W. trimmer...	—
C24‡	B.-P. sec. M.W. trimmer	—
C25‡	B.-P. sec. L.W. trimmer...	—
C26†	Band-pass sec. tuning ...	—
C27‡	Aerial S.W. trimmer ...	—
C28‡	Osc. circ. S.W. trimmer...	—
C29†	Oscillator circuit tuning...	—
C30‡	Osc. circ. M.W. trimmer...	—
C31‡	Osc. circ. L.W. trimmer...	—
C32‡	Osc. circ. M.W. tracker ...	—
C33‡	Osc. circ. L.W. tracker ...	—
C34‡	1st I.F. trans. pri. tuning	—
C35‡	1st I.F. trans. sec. tuning	—
C36‡	2nd I.F. trans. pri. tuning	—
C37‡	2nd I.F. trans. sec. tuning	—

* Electrolytic. † Variable. ‡ Pre-set.



	RESISTORS	Values (ohms)
R1	A2 series resistor ...	22,000
R2	V1 hex. C.G. decoupling...	1,200,000
R3, R4	V1 S.G. H.T. potential divider	33,000, 47,000
R5	V1 fixed G.B. resistor ...	100
R6	V1 osc. C.G. resistor ...	47,000
R7	V1 osc. anode H.T. feed...	10,000
R8	V2 S.G. H.T. feed ...	47,000
R9	V2 fixed G.B. resistor ...	100
R10	I.F. stopper	33,000

(*Continued overleaf*)

arallel on M.W., ment operations, iron-dust cores.

	RESISTORS (*continued*)	Values (ohms)
R11	Manual volume control ...	500,000
R12	V3 C.G. resistor	470,000
R13	V3 fixed G.B. resistor ...	3,300
R14	V3 H.T. decoupling ...	22,000
R15	V3 triode anode load ...	150,000
R16	A.V.C. line decoupling ...	1,200,000
R17	V3 A.V.C. diode load ...	1,200,000
R18	V4 C.G. resistor	470,000
R19	V4 C.G. stopper	180,000
R20	V4 fixed G.B. resistor ...	180
R21	H.T. smoothing resistor ...	1,200

	OTHER COMPONENTS		Approx. Values (ohms)
L1	Aerial M.W. coupling coil...		1·25
L2	Aerial L.W. coupling coil...		4·0
L3	Band-pass primary coils ...		3·5
L4			18·5
L5	Aerial S.W. tuning coil ...		Very low
L6	Band-pass secondary coils		3·5
L7			18·5
L8	Osc. S.W. tuning coil ...		Very low
L9	Osc. M.W. tuning coil ...		4·5
L10	Osc. L.W. tuning coil ...		8·0
L11	Osc. S.W. reaction coil ...		0·7
L12	1st I.F. trans.	Pri. ...	4·0
L13		Sec. ...	4·0
L14	2nd I.F. trans.	Pri. ...	10·0
L15		Sec. ...	10·0
L16	Speaker speech coil ...		2·5
T1	Speaker input trans...	Pri.	650·0
		Sec.	0·4
T2	Mains trans.	Pri., total ...	36·0
		Heater sec. ...	0·15
		Rect. heat. sec....	0·2
		H.T. sec., total...	1200·0
S1-S13	Waveband switches ...		—
S14	Mains switch, ganged R11		—

VALVE ANALYSIS

Valve voltages and currents given in the table below are those measured in our receiver when it was operating on mains of 232 V, using the 230 V tap on the mains transformer. The receiver was tuned to the lowest wavelength on the medium band and the volume control was at maximum, but there was no signal input.

Valve	Anode Voltage (V)	Anode Current (mA)	Screen Voltage (V)	Screen Current (mA)
V1 ECH35	213	2·0	80	2·8
	Oscillator			
	142	7·0		
V2 EF39	213	8·5	87	2·5
V3 EBC33	67	0·7	—	—
V4 EL33	200	25·0	213	3·1
V5 AZ31	300†	—	—	—

Each anode, A.C.

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

DISMANTLING THE SET

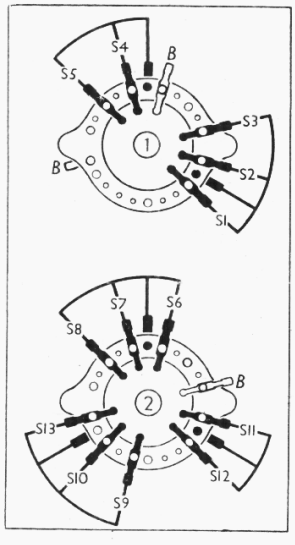
Removing Chassis.—Remove the two round-head wood screws holding the rear of the chassis to the base of the cabinet;

remove the three round-head screws (two at the top and one near the bottom on the right-hand side) holding the front panel to the front edge of the cabinet;

from beneath the cabinet remove a fourth (countersunk head) screw holding the front panel in position;

if the chassis is now pushed forward, the front panel, with chassis and speaker attached to it, can be withdrawn from the front of the cabinet.

When replacing, the long round-head set-screw goes in the left-hand bracket at the top of the cabinet, the two shorter ones going on the right.



Diagrams of the two waveband switch units, both drawn as seen when viewed from the rear of an inverted chassis. Blank tags are indicated by *B*. The associated switch table is in the next column.

Dismounting Chassis.—To separate the chassis from the front panel, remove the three control knobs (two recessed grub screws each);

from the two tags on the speaker input transformer unsolder the speaker leads;

remove the wooden batten securing the bottom front edge of the chassis (two countersunk-head wood screws);

remove the two round-head wood screws holding the tops of the uprights at the front of the chassis to the front panel.

Removing Speaker.—Remove the four cheese-head screws (with spring washers) holding the speaker to the sub-baffle.

When replacing, the transformer should be at the top.

GENERAL NOTES

Switches.—S1-S13 are the waveband 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. 2, where they are drawn as seen when viewed from the rear of an inverted chassis.

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

S14 is the Q.M.B. mains switch, ganged with the manual volume control **R11.**

Coils.—The band-pass circuit coils **L1, L3, L6** and **L2, L4, L7** are in two unscreened tubular units beneath the chassis. **L5** forms a third unscreened unit beneath the chassis, mounted on its own wiring. The oscillator circuit coils **L8-L11** are in a screened unit on the chassis deck. The two I.F. transformers **L12, L13** and **L14, L15** are in two further screened units on the chassis deck with their associated trimmers. **L12** and **L13** have iron-dust cores.

Switch Table

Switch	S.W.	M.W.	L.W.
S1	C	—	—
S2	—	C	—
S3	—	—	C
S4	—	C	—
S5	—	—	C
S6	C	—	—
S7	—	C	—
S8	—	—	C
S9	—	—	C
S10	—	C	—
S11	—	C	—
S12	C	—	—
S13	C	—	—

Scale Lamps.—These are two Osram lamps, with M.E.S. bases and large clear spherical bulbs, rated at 4.5 V, 0.3 A. They are connected in series across the heater secondary of the mains transformer **T2.**

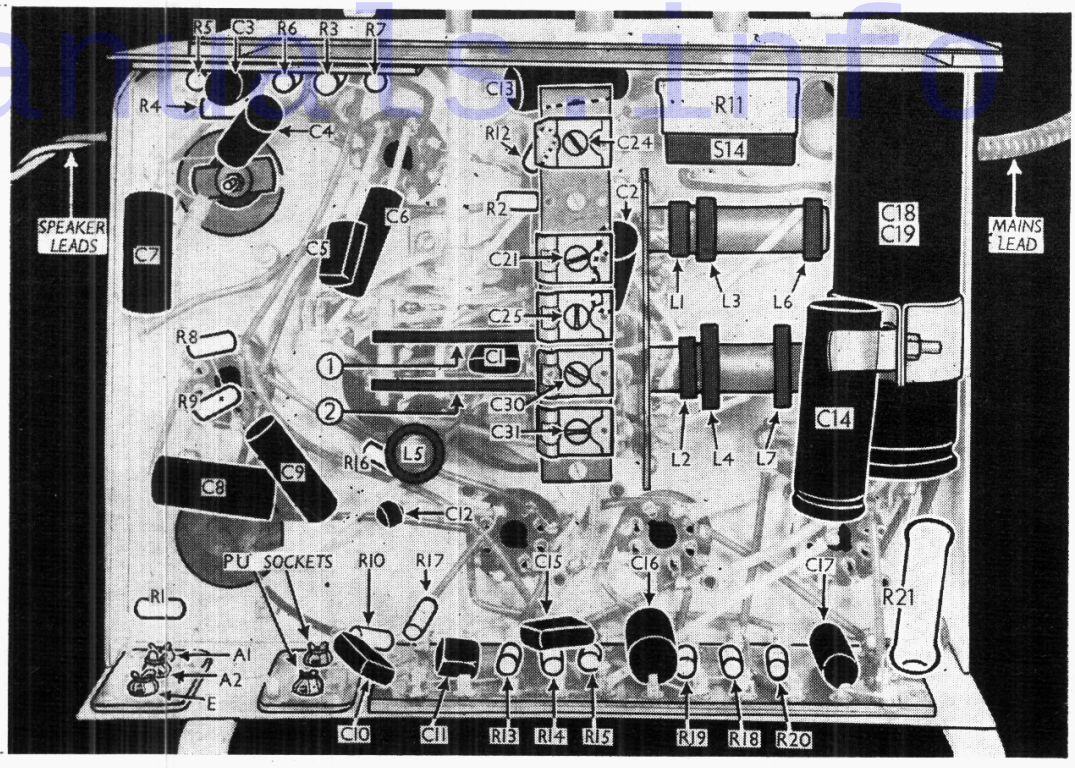
External Speaker.—Two sockets are provided on the internal speaker input transformer for the connection of a low impedance (about 2-5 Ω) external speaker.

Capacitor C9.—This may be omitted in some chassis.

Capacitor C14.—This is an electrolytic type in a tubular metal container, mounted in a clip beneath the chassis. It is rated at 2 μF, 350 V D.C. working. The can forms the negative connection.

Capacitors C18, C19.—These are two electrolytics in a single tubular metal container mounted in a clip beneath the chassis deck. The red tag is the positive connection of **C18,** which is rated at 16 μF, 450 V D.C. working, and is a surge-proof type. The yellow tag is the positive of **C19,** which is rated at 16 μF, 450 V D.C. working, 500 V peak. The black tag is the common negative connection.

Resistor R21.—This is the H.T. smoothing resistor, beneath the chassis. It is rated at 1,200 Ω, 7 watts, and is wire-wound.



Under - chassis view. The aerial and earth sockets, and the pick-up sockets, are mounted on the rear member, but the external speaker sockets are mounted on the internal speaker connecting panel, on the input transformer. **L5** is mounted on its own wiring.

CIRCUIT ALIGNMENT

Although the I.F. adjustments alone can be carried out while the chassis remains in the cabinet, the chassis must be removed for R.F. adjustments. Removal is a very simple process, however, as the chassis and speaker are both mounted on the removable front panel. The construction then permits the chassis to be rested in such a desired position as to give convenient access to all adjustments.

I.F. Stages.—Connect signal generator lead to control grid (top cap) of **V1** and chassis, and turn the volume control to maximum. Feed in a 450.5 kc/s (666 m) signal, and adjust **C34, C35, C36** and **C37** in turn for maximum output.

Oscillator Stage.—Owing to the interdependence of certain adjustments, the three bands cannot be aligned separately in the usual sequence, and for this reason it is important that the order adopted here should be followed. The signal generator leads remain connected to **V1** top cap and chassis. With the gang at maximum, the pointer should lie along the horizontal line crossing the centre of the scale.

Switch set to S.W., tune to 19 Mc/s on scale, feed in a 19 Mc/s (15.79 m) signal, and adjust **C28** for maximum output.

Switch set to M.W., tune to 200 m on scale, feed in a 200 m (1,500 kc/s) signal, and adjust **C30** for maximum output.

Switch set to L.W., tune to 1,200 m on scale, feed in a 1,200 m (250 kc/s) signal, and adjust **C31** for maximum output.

Feed in a 1,875 m (160 kc/s) signal, tune it in, and adjust **C33** to give the correct reading (spot on scale). Readjust **C31** if necessary. **C33** is painted blue.

Switch set to M.W., feed in a 500 m (600 kc/s) signal, tune it in, and adjust **C32** to give the correct scale reading. **C32** is painted red.

R.F. Stage.—Transfer signal generator leads to **A1** and **E** sockets, via a suitable dummy aerial.

Switch set to S.W., feed in a 50 m (6 Mc/s) signal, tune it in, and adjust **C27** for maximum output while rocking the gang for optimum results.

Switch set to M.W., tune to about 231 m (spot on scale), feed in a 231 m (1,300 kc/s) signal, and adjust **C23** and **C24** for maximum output.

Switch set to L.W., tune to 1,200 m on scale, feed in a 1,200 m (250 kc/s) signal, and adjust **C21** and **C25** for maximum output. Feed in a 1,875 m (160) kc/s) signal, tune it in, and readjust **C33** for maximum output.

Switch set to M.W., feed in a 500 m (600 kc/s) signal, tune it in, and readjust **C32** for maximum output.

BANDMASTER SERVICING EQUIPMENT

Two New Test Meters

A GENERAL-PURPOSE multi-range test meter and a three-range meter for counter use are two new Bandmaster products.

The general-purpose meter is the U18, with eighteen ranges calibrated on wide, open scales. The movement is pivoted on jewels, and is dead-beat in action. The scale face is inclined to facilitate viewing.

All ranges are selected by a single rotary control, and a single pair of terminals serves all ranges, so that operation is simplified in the greatest degree. There are nine D.C. ranges : 0-1 V, 0-10 V, 0-100 V, 0-500 V, 0-1,000 V ; and 0-5 mA, 0-20 mA, 0-100 mA, 0-500 mA.

The remaining nine ranges are : 0-10 V, 0-100 V, 0-500 V, 0-1,000 V A.C. ; three resistance ranges 0-2,000 Ω, 0-200,000 Ω and 0-1,000,000 Ω (which can be extended by external batteries to 2,000,000 Ω) ; a capacitance range scaled 0.001-2.0 μF ; and a D.C. range of 0-100 mV for use with external shunts for large current readings.

This instrument is listed at £14 (less 25 per cent trade discount), complete with hand strap and leads.

The counter meter has three ranges : 0-10 V and 0-10 mA (1,000 Ω movement) and 200 V. It is intended for counter use, and is fitted with a strut to tilt the case for the customer's convenience. Range selection is effected by alternative terminals. The trade price is £4 19s 6d.

The sole distributing agents for these instruments are Lugton & Co., Ltd., Radio House, 209-212 Tottenham Court Road, London, W.1.

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