Supplement to The Wireless & Electrical Trader, March 23, 1946

"TRADER" SERVICE SHEET

763

FERRANTI 145

THREE-BAND A.C. SUPERHET

The Ferranti 145 superhet.

FERRANTI'S first post-war model, the 145, is a 4-valve (plus rectifier) 3-band superhet designed to operate from A.C. mains of 190-260 V, 40-100 c/s. The S.W. range is 16.7-52 m.

Provision is made for the connection of a gramophone pick-up and an external speaker.

Release date and original price: September, 1945; £15 0s., plus £3 4s. 6d. purchase tax.

CIRCUIT DESCRIPTION

Aerial input via coupling coils **L3** (S.W.), **L4** (M.W.) and **L5** (L.W.) to single-tuned circuits **L6, C34** (S.W.), **L7, C34** (M.W.) and **L8, C34** (L.W.). Aerial circuit I.F. filtering by **L1, C29.**

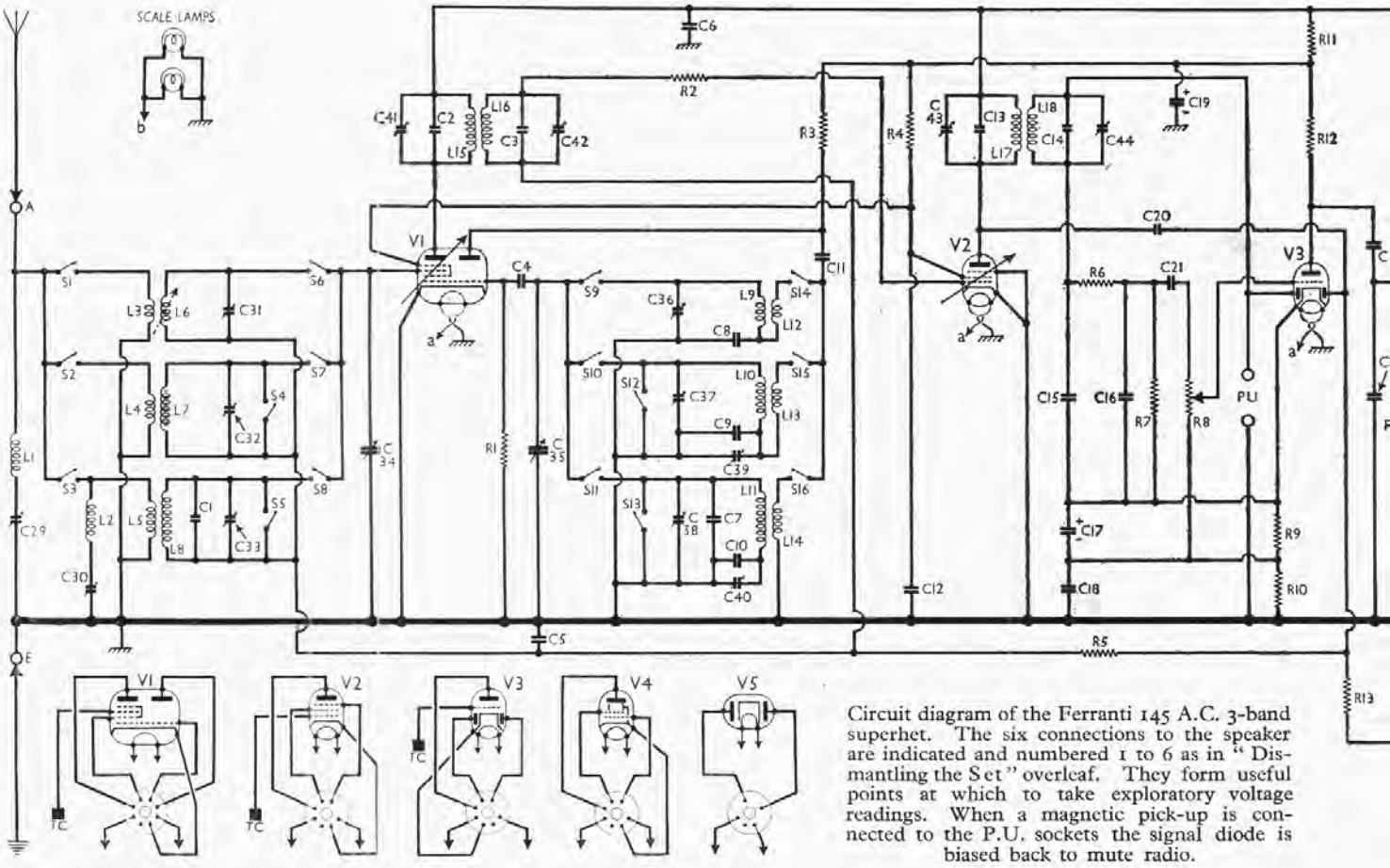
First valve **(V1, Ferranti 6K8G)** is a triode-hexode operating as frequency changer with internal coupling. Triode oscillator control grid circuit coils **L9** (S.W.), **L10** (M.W.) and **L11** (L.W.) are tuned by **C35.** Parallel trimming by **C36** (S.W.), **C37** (M.W.) and **C7, C38** (L.W.); series tracking by **C8** (S.W.), **C9, C39** (M.W.) and **C10, C40** (L.W.). Reaction coupling from anode by coils **L12** (S.W.), **L13** (M.W.) and **L14** (L.W.), and the common impedance of the trackers in grid and anode circuits on S.W. and M.W.

Second valve **(V2, Ferranti 6K7G)** is a variable-mu R.F. pentode operating as intermediate frequency amplifier with tuned-primary, tuned-secondary transformer couplings **C41, C2, L15, L16, C3, C42** and **C43, C13, L17, L18 C14, C44.**

Intermediate frequency 465 kc/s.

Diode second detector is part of double diode triode valve **(V3, Ferranti 6Q7G).** Audio frequency component in rectified output is developed across load resistor **R7** and passed via A.F. coupling capacitor **C21** and manual volume control **R8** to control grid of triode section, which operates as audio-frequency amplifier.

IF filtering by **C15, R6** and **C16** in diode circuit. Provision for connection of a gramophone pick-up between the signal diode and chassis, so that the input is applied via **L18,** the potential divider formed by **R6, R7,** and **C21, R8** to the



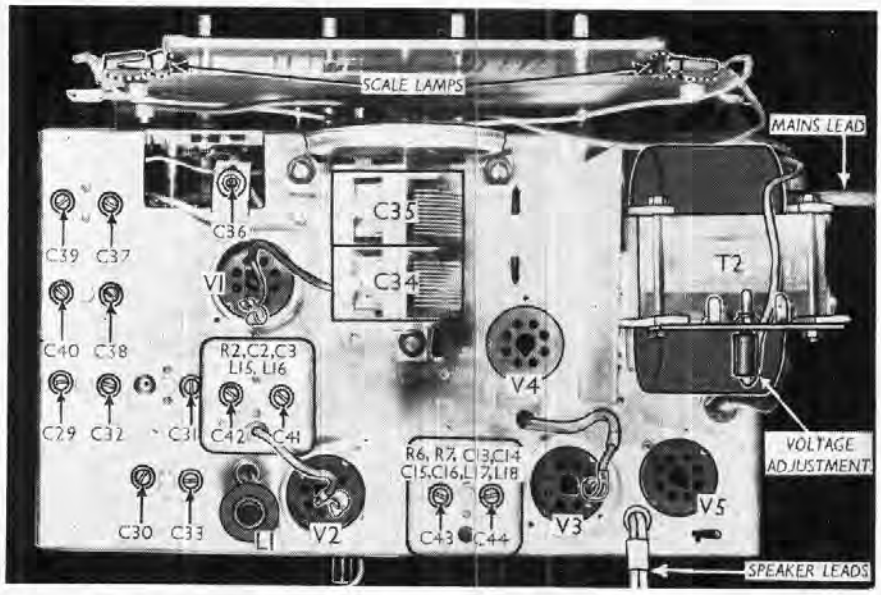
Circuit diagram of the Ferranti 145 A.C. 3-band superhet. The six connections to the speaker are indicated and numbered 1 to 6 as in "Dismantling the Set" overleaf. They form useful points at which to take exploratory voltage readings. When a magnetic pick-up is connected to the P.U. sockets the signal diode is biased back to mute radio.

triode control grid. Provided that the pick-up connections form D.C. continuity between the diode and chassis, the potential between the cathode and chassis is applied as bias to the signal diode, muting radio signals.

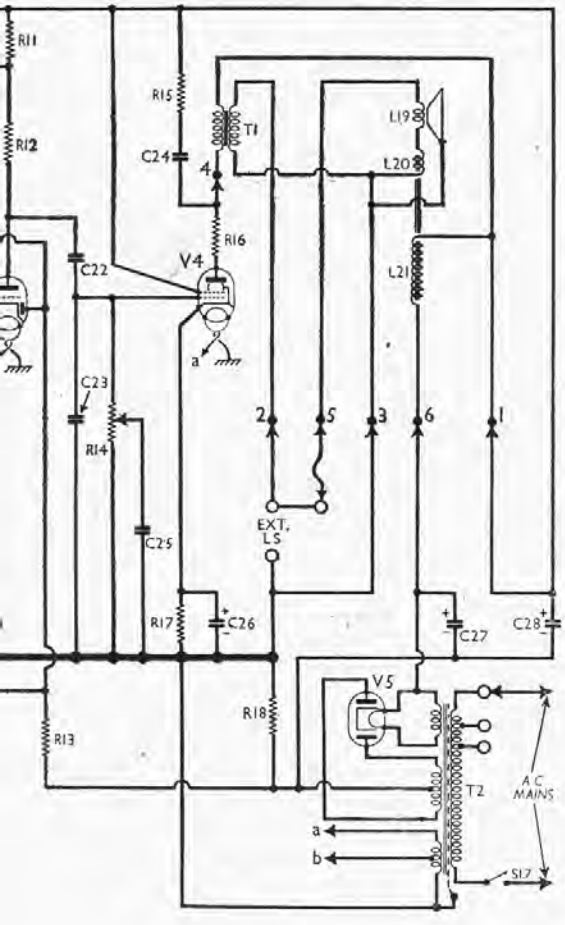
Second diode of **V3,** fed from **V2** anode via **C20,** provides D.C. potential which is developed across load resistor **R13** and fed back through decoupling circuit as G.B. to F.C. and I.F. valves, giving automatic volume control.

Resistance-capacitance coupling by **R12, C22** and **R14** between **V3** triode and beam tetrode output valve **(V4, Ferranti 6V6G).** Fixed tone correction by **R15, C24** in anode circuit, variable tone control by **R14, C25** in control grid circuit, where further I.F. filtering is effected by **C23.** Provision for the connection of a low impedance external speaker across secondary of internal speaker input transformer **T1,** a plug and socket device permitting the internal speaker to be muted.

H.T. current is supplied by I.H.C. full-wave rectifying valve **(V5, Ferranti 5Z4G).** Smoothing by speaker field **L21** and electrolytic capacitors **C27, C28.** Fixed G.B. potential for **V1** and **V2** is obtained from the drop along **R18** in the negative H.T. lead to chassis, and is applied via the A.V.C. line. The delay potential for the A.V.C. diode is derived from the combined drops along **R18** and resistors **R9, R10** in **V3** cathode lead to chassis. G.B. for **V3** triode alone is obtained from the drop along **R9.**



Plan view of the chassis. Each of the I.F. coil units contains several other components. All the pre-set trimmer adjustments are indicated here.



The two scale lamps are energised from a tapping on the heater secondary winding of the mains transformer **T2** in most cases, where the lower voltage lamps are used, but in some cases they are connected across the whole winding.

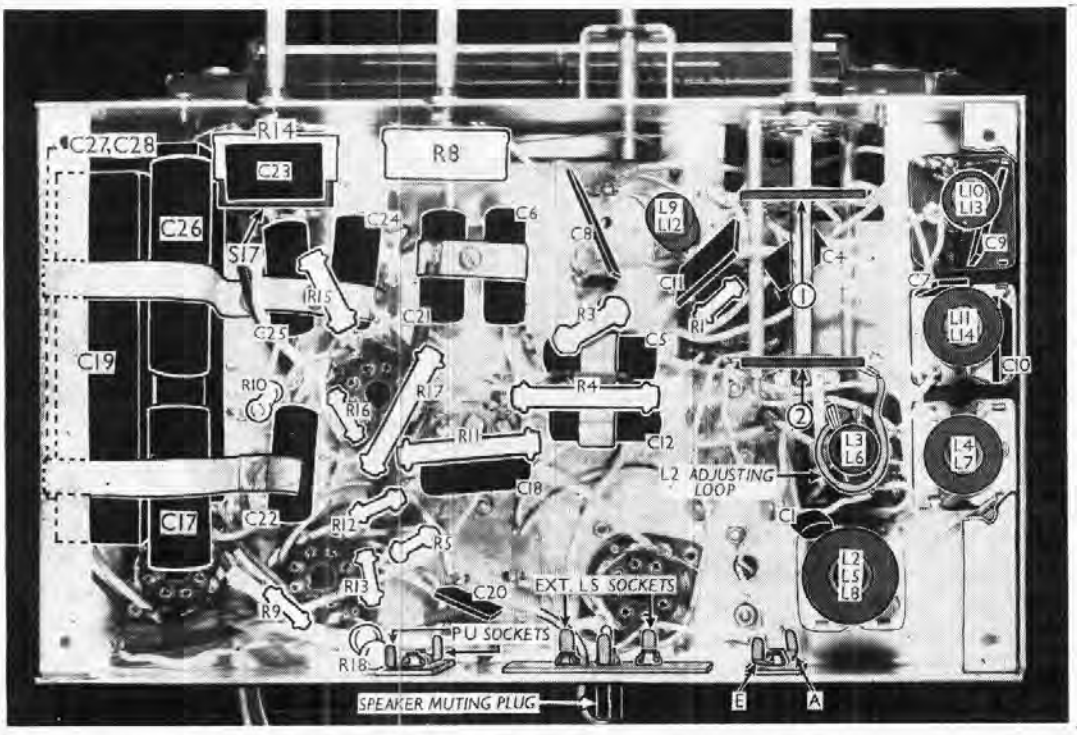
COMPONENTS AND VALUES

	CAPACITORS	Values (μF)
C1	Aerial L.W. fixed trimmer	0·00005
C2	1st I.F. transformer fixed trimmers	0·00009
C3		0·00009
C4	V1 osc. C.G. capacitor	0·0001
C5	A.V.C. line decoupling	0·05
C6	H.T. circuit R.F. by-pass	0·1
C7	Osc. L.W. fixed trimmer	0·0001
C8	Osc. S.W. tracker	0·004
C9	Osc. M.W. fixed tracker	0·0004
C10	Osc. L.W. fixed tracker	0·00015
C11	V1 osc. anode coupling	0·001
C12	V1, V2 S.G.'s decoupling	0·1
C13	2nd I.F. transformer fixed trimmers	0·00009
C14		0·00009
C15	I.F. by-pass capacitors	0·00015
C16		0·00015
C17*	V3 cathode by-pass capacitors	50·0
C18		0·1
C19*	H.T. line decoupling	4·0
C20	A.V.C. diode coupling	0·00005
C21	A.F. coupling to V3 triode	0·02
C22	A.F. coupling to V4	0·05
C23	I.F. by-pass	0·0004
C24	Fixed tone corrector	0·005
C25	Part of tone control	0·005
C26*	V4 cathode by-pass	50·0
C27	H.T. smoothing capacitors	16·0
C28		8·0
C29‡	Aerial I.F. filter tuning	0·00007
C30‡	Image suppressor tuning	0·00007
C31‡	Aerial circ. S.W. trimmer	0·00002
C32‡	Aerial circ. M.W. trimmer	0·00002
C33‡	Aerial circ. L.W. trimmer	0·00007
C34†	Aerial circuit tuning	—
C35†	Oscillator circuit tuning	—
C36‡	Osc. circ. S.W. trimmer	0·00004
C37‡	Osc. circ. M.W. trimmer	0·00007
C38‡	Osc. circ. L.W. trimmer	0·00007
C39‡	Osc. circ. M.W. tracker	0·0002
C40‡	Osc. circ. L.W. tracker	0·00007
C41‡	1st I.F. trans. pri. tuning	0·00007
C42‡	1st I.F. trans. sec. tuning	0·00007
C43‡	2nd I.F. trans. pri. tuning	0·00007
C44‡	2nd I.F. trans. sec. tuning	0·00007

* Electrolytic. † Variable. ‡ Pre-set.

	RESISTORS	Values (ohms)
R1	V1 osc. C.G. resistor	47,000
R2	V2 C.G. stopper	5,600
R3	V1 osc. anode H.T. feed	22,000
R4	V1, V2 S.G. H.T. feed	10,000
R5	A.V.C. line decoupling	2,200,000
R6	I.F. stopper	100,000
R7	V3 signal diode load	470,000
R8	Manual volume control	1,000,000
R9	V3 triode G.B. and A.V.C. delay resistors	2,200
R10		3,300
R11	H.T. feed resistor	6,800
R12	V3 triode anode load	100,000
R13	V3 A.V.C. diode load	2,200,000
R14	Variable tone control	500,000
R15	Part of tone corrector	22,000
R16	V4 anode stopper	100
R17	V4 G.B. resistor	270
R18	V1, V2, fixed G.B. resistor, part A.V.C. delay	47

	OTHER COMPONENTS	Approx. Values (ohms.)
L1	Aerial I.F. filter coil	37·0
L2	Image suppressor coil	5·0
L3	Aerial S.W. coupling coil	0·3
L4	Aerial M.W. coupling coil	40·0
L5	Aerial L.W. coupling coil	66·0
L6	Aerial S.W. tuning coil	Very low
L7	Aerial M.W. tuning coil	3·0
L8	Aerial L.W. tuning coil	27·0
L9	Osc. S.W. tuning coil	Very low
L10	Osc. M.W. tuning coil	5·0
L11	Osc. L.W. tuning coil	12·0
L12	Osc. S.W. reaction coil	0·4
L13	Osc. M.W. reaction coil	0·4
L14	Osc. L.W. reaction coil	4·0
L15	1st I.F. trans. Pri.	9·0
L16	Sec.	9·0
L17	2nd I.F. trans. Pri.	9·0
L18	Sec.	9·0
L19	Speaker speech coil	2·5
L20	Hum neutralising coil	0·2
L21	Speaker field coil	1,000·0
T1	Speaker input trans. Pri.	350·0
	Sec.	0·2
T2	Mains trans. Pri., total	27·0
	Heater, sec.	0·15
	Rect. heat. sec.	0·15
	H.T. sec., total	300·0
S1-S16	Waveband switches	—
S17	Mains switch, ganged R14	—



Under - chassis view. The waveband switch units are indicated by numbers 1 and 2 in circles, and arrows show the direction in which they are viewed in the diagrams in col. 4 opposite. The inductance adjustment loop of **L6** is clearly shown.

VALVE ANALYSIS

Valve voltages and current given in the table below are those quoted by the makers. They were measured in a receiver when it was working with the mains voltage adjustment correctly set.

The receiver was switched to the L.W. band, and the volume control was turned to maximum, but there was no signal input.

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

Value	Anode Voltage (V)	Anode Current (mA)	Screen Voltage (V)	Screen Current (mA)
V1 6K8G	300	2·1	114	6·6
	Oscillator			
	110	4·1		
V2 6K7G	300	9·2	114	2·4
V3 6Q7G	110	0·8	—	—
V4 6V6G	290	49·0	300	4·4
V5 5Z4G	350†	—	—	—

† Each anode, A.C.

DISMANTLING THE SET

Removing Chassis.—Remove the four control knobs (pull off);

remove the four special cheese-head screws, which have large metal washers fixed under their heads.

The chassis may now be withdrawn to the extent of the speaker leads, which are of adequate length to permit most operations to be carried out without the need to disconnect them. Care should be taken with the first movement of the chassis to ease the mains transformer from the recess cut for it in the rib on the side of the cabinet.

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

When replacing, one thick rubber washer should be inserted between the bottom of the chassis and the base of the cabinet for each fixing screw, so that the screw passes through it. The bolts must not be pulled up too tightly, as the chassis should float on the rubber washers.

Connect the speaker leads as follows, numbering the tags on the speaker transformer from left to right: 1, plain red lead; 2, yellow braided lead; 3, black lead; 4, green lead; 5, red lead with black sleeve at end; 6, blue lead. These tags are indicated in the circuit diagram, where they bear the same numbers.

Removing Speaker.—Remove the nuts (with washers) from the four screws holding the speaker to the sub-baffle.

When replacing, the transformer should be at the top, and the leads should be connected as described previously.

GENERAL NOTES

Switches.—S1-S16 are the waveband switches, ganged in two rotary units beneath the chassis. These are indicated by numbers in circles and arrows in our under-chassis view, and shown in detail in the diagrams in col. 4, where they are drawn as seen when viewed from the rear of the underside of the chassis.

The table (col. 3) gives the switch positions for the three control settings, starting from the fully anti-clockwise position of the control spindle. A dash indicates open, and **C**, closed.

S17 is the Q.M.B. mains switch, ganged with the variable tone control **R14.**

Coils.—The aerial circuit coils **L2, L5, L8; L3, L6; L4, L7;** and the oscillator circuit coils **L9, L12; L10, L13; L11, L14;** are in six unscreened tubular units beneath the chassis, grouped about the waveband switch assembly and, with the exception of **L9, L12,** mounted on their trimmer units. The aerial circuit I.F. filter coil **L1** is mounted in an unscreened unit on the chassis deck, but its associated pre-set capacitor **C29** forms part of the trimmer assembly upon which the **L4, L7** coil unit is mounted.

The I.F. transformers **L15, L16** and **L17, L18** are in two screened units on the chassis deck, containing in addition to their own trimmers several other components. The first I.F. unit contains **R2,** and the second one **R6, R7** and **C5, C16.** Also, in each unit the tuning capacitances comprise fixed and pre-set capacitors connected in parallel.

Scale Lamps.—In most cases these are, as in our sample, two Osram M.E.S. type lamps, with small clear spherical bulbs, rated at 3.5 V, 0.3 A. They are energised from the heater secondary of the mains transformer, which is 6 V, but a tapping is provided specially for them. In a few early samples the lamps were rated at 6.5 V, 0.3 A, and they were then connected directly across the whole heater secondary winding.

Gramophone Pick-up.—Two sockets are provided at the rear of the chassis for the connection of a gramophone pick-up, and they are so wired that when the sockets are connected together a muting bias is

Switch Table

Switch	S.W.	M.W.	L.W.
S1 ...	C	—	—
S2 ...	—	C	—
S3 ...	—	—	C
S4 ...	C	—	—
S5 ...	C	C	—
S6 ...	C	—	—
S7 ...	—	C	—
S8 ...	—	—	C
S9 ...	C	—	—
S10 ...	—	C	—
S11 ...	—	—	C
S12 ...	C	—	—
S13 ...	C	C	—
S14 ...	C	—	—
S15 ...	—	C	—
S16 ...	—	—	C

applied to the signal diode. For pick-up operation, therefore, D.C. continuity should be maintained between the sockets. The pick-up should not be of the crystal variety.

External Speaker.—Two sockets are provided at the rear of the chassis for the connection of a low impedance (3-6Ω) external speaker. A third socket, between these two, normally contains a plug on a flying lead, but the plug may be withdrawn to mute the internal speaker if desired.

Capacitor C19.—This is a Ferranti dry electrolytic in a rectangular waxed card board carton beneath the chassis. It is rated at 4 μF, 500 V peak.

Capacitors C27, C28.—These are two Ferranti dry electrolytics in a single rectangular waxed cardboard carton beneath the chassis. The red lead is the positive connection of **C27** (16 μF), the yellow lead that of **C28** (8 μF), and the black lead, which goes to HT negative (not chassis) is the common negative connection.

Capacitors C17, C26.—These are two Ferranti tubular electrolytics in cardboard containers beneath the chassis, used to by-pass the cathode circuits of **V3** and **V4**. **C17** is rated at 50 μF, 12 V peak; **C26** is rated at 50 μF, 20 V peak.

All these electrolytics, **C19; C27, C28; C17** and **C26** are held together in a group beneath a pair of clamps at one end of the chassis.

CIRCUIT ALIGNMENT

I.F. Stages.—Turn the gang to maximum, the tone control as far anti-clockwise as it will go without operating the switch, and switch the set to L.W. Connect signal generator leads via a 0.05 μF capacitor to control grid (top cap) of **V1** and chassis, feed in a 465 kc/s (645.16 m) signal, and adjust **C41, C42, C43** and **C44** for maximum, but adjusting signal generator attenuator at the same time to maintain a reading of about 50 mW on the output meter.

To check sensitivity of I.F. stages, adjust attenuator to produce 50 mW reading on output meter. With signal generator connected as above, its output should not now exceed 120 μV. If the signal generator lead is transferred from the top cap of **V1** to the top cap of **V2**, and the attenuator is again adjusted, but nothing else is altered, the signal generator output should not now exceed 2 mV.

R.F. and Oscillator Stages.—With the gang at maximum capacitance, the pointer should lie along the two horizontal gilt lines running left and right across the scale. See that the scale sits squarely in its mounting, and that the small hole in the gilt centre-panel is concentric with the pointer spindle. Transfer signal generator leads to **A** and **E** sockets via a suitable dummy aerial.

I.F. Filter.—With controls adjusted as described for I.F. stages, feed in a strong 465 kc/s signal and adjust **C29** for minimum output.

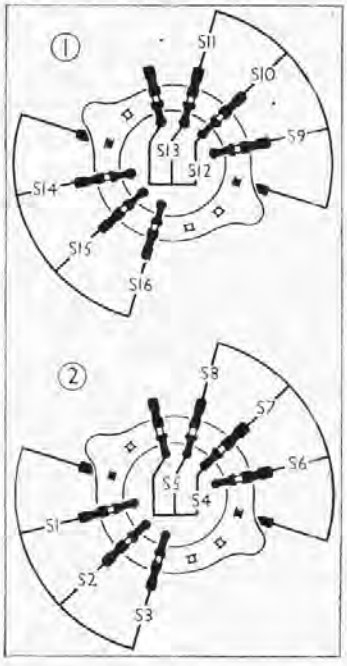
M.W.—Switch set to M.W., tune to 200 m on scale, feed in a 200 m (1,500 kc/s) signal, and adjust **C37** for maximum output. Feed in a 228 m (1,316 kc/s) signal, tune it in, and adjust **C32** for maximum output. Feed in a 500 m (600 kc/s) signal, tune it in, and adjust **C39** for maximum output while rocking the gang for optimum results. Repeat all the M.W. adjustments in the same order until no improvement can be obtained, finishing up with a final check at 200 m.

L.W.—Switch set to L.W., tune to 1,000 m on scale, feed in a 1,000 m (300 kc/s) signal, and adjust **C38** for maximum output. Feed in a 1,128 m (266 kc/s) signal, tune it in, and adjust **C33** for maximum output. Feed in an 1,800 m (166.5 kc/s) signal, tune it in, and adjust **C40** for maximum output while rocking the gang for optimum results. Then repeat the whole of the L.W. adjustments.

Image Rejector.—To adjust the image (or second channel) rejector, feed in a strong 261 m (1,149 kc/s) signal (greater than 0.1 V) and tune in the image at about 1,370 m. Then adjust **C30** for minimum output.

S.W.—Switch set to S.W., tune to 16.67 m on scale, feed in a 16.67 m (18 Mc/s) signal, screw both **C31** and **C36** right down, and unscrew **C36** slowly until a signal is indicated. Pass the first peak, and continue unscrewing until the second peak is reached, then adjust **C36** accurately for maximum output on the second peak.

Feed in a 20 m (15 Mc/s) signal, tune it in, and adjust **C31** for maximum output, then rock gang slightly one way and readjust **C31**; then rock it slightly the other way and readjust **C31**; and so on until no improvement can be obtained. Finally, feed in a 40 m (7.5 Mc/s) signal, tune it in, and adjust the loop in the connecting wire from the waveband switch unit to **L6** for maximum output.



Diagrams of the waveband switch units, drawn as seen from the rear of an inverted chassis.

TEST REPORT

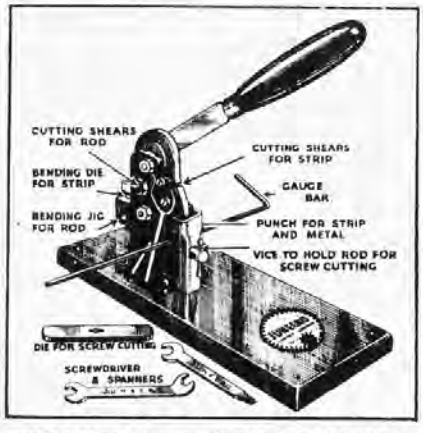
JUNEERO MULTI-PURPOSE TOOL

A Useful Item in the Workshop

LITTLE jobs like making up clips, screens, rods and brackets for mounting such components as controls, scale lamps, coils and connecting panels are always cropping up in the radio workshop, and although there is no difficulty in performing the necessary operations, considerable time is involved usually in seeking out a suitable piece of metal, marking it, drilling it, shaping it and so on, and a tool that will perform these functions readily is very handy.

Such a device is the Juneero multi-purpose tool. Originally intended for model makers, its adaptability for serious work has led to its adoption in many light workshops, among which, the makers claim, are many Post Office radio departments. Used with the metal strip and rod supplied by its makers, it will bend an accurate right angle in the strip, cut it cleanly to the required length straight across or at an angle, and stamp holes or slots in it, each operation being performed by a single stroke of the operating lever. Similarly, it will cut and bend the rod, and a die supplied with it will cut a thread on the rod while it is held firmly in a vice on the body of the tool.

The working head of the tool consists of a steel plate in which are machined two



cutting edges, a punching stub and the bending die, which operate in conjunction with their fixed counterparts on the body of the tool. The head is operated by a hand lever, and the ratio of movement is such as to require very little effort on the part of the operator.

The general outline can be gleaned from the illustration above, where the various functions are indicated. The gauge bar is used as a jig to permit uniform repetition of any operation where several pieces are to be made to the same dimensions. Supplied with the tool are quantities of sheet metal (flat and corrugated), metal discs, standard strips, rods, angle-iron, springs, bolts and a substitute glass material that might be useful for scale windows. There are also several accessories, such as spanners, metal-cutting shears, the screw-threading die and a scroll tool for putting curved bends of various radii in the strip or rod. This is useful for making earth clips, for instance.

The makers are Juneero, Ltd., Stirling Corner, Boreham Wood, Herts, and the complete outfit (No. 2) retails at two guineas. A smaller outfit (No. 1), containing the same tool but considerably less equipment, costs 25s.

Printed in England by The Cornwall Press Ltd., Paris Garden, London, S.E.1.