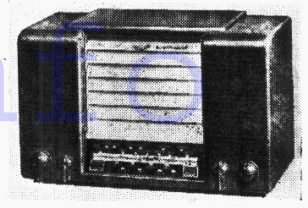


"TRADER" SERVICE SHEET

# 811

# INVICTA

## MODEL 60



**T**HE Invicta Model 60 is a 3-valve (plus rectifier) 3-band superhet, designed to operate from A.C. or D.C. mains of 200-250 V, 40-100 c/s in the case of A.C.  
Release date and original price: January, 1947; £14 5s plus £3 1s 3d purchase tax.

### CIRCUIT DESCRIPTION

Aerial input is via coupling coils **L1** (S.W.) and **L2** (M.W. and L.W.) to single-tuned circuits **L3**, **C30** (S.W.), **L4**, **C30** (M.W.) and **L5**, **C30** (L.W.), which precede a triode-hexode valve (**V1**, Mullard metallized **GCH35**) operating as frequency changer with internal coupling.

Triode oscillator anode coils **L9** (S.W.), **L10** (M.W.) and **L11** (L.W.) are tuned by **C34**. Parallel trimming by **C31** (S.W.), **C10**, **C32** (M.W.) and **C11**, **C33** (L.W.); series tracking by **C12** (S.W.) and **C13** (M.W. and L.W.). Reaction coupling by grid coils **L6** (S.W.), **L7** (M.W.) and **L8** (L.W.).

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 **C6**, **L12**, **L13**, **C7** and **C16**, **L14**, **L15**, **C17**. All the tuning capacitors are fixed, and trimming is effected by varying the positions of the iron-stud cores.

Intermediate frequency 465 kc/s.

Diode second detector is part of double diode pentode output valve (**V3**, Mullard metallized **CBL31**).

Second diode of **V3**, fed from **L15** via **C22**, provides D.C. potentials which are developed across load resistor **R14** and fed back through a decoupling circuit as G.B., to F.C. and I.F. valves, giving automatic volume control. Delay voltage, together with G.B. for pentode section, is obtained from the drop along resistors **R11**, **R12** in **V3** cathode lead to chassis.

The output from **V3** pentode anode is developed across a potential divider comprising **C23**, **R15**, **R16**, **R17**, **R18** and switches **S15**, **S16**, and the fraction of the output appearing across **R18** is fed back via **R9** to the pentode control grid. Bias for this grid is obtained by returning **R18** to the junction of **R11**, **R12**.

For tone control purposes, the frequency characteristic of the feed-back circuit is modified, from the "Brilliance" condition (both switches open) to "Normal" (**S15** closed) and Mellow (**S16** closed).

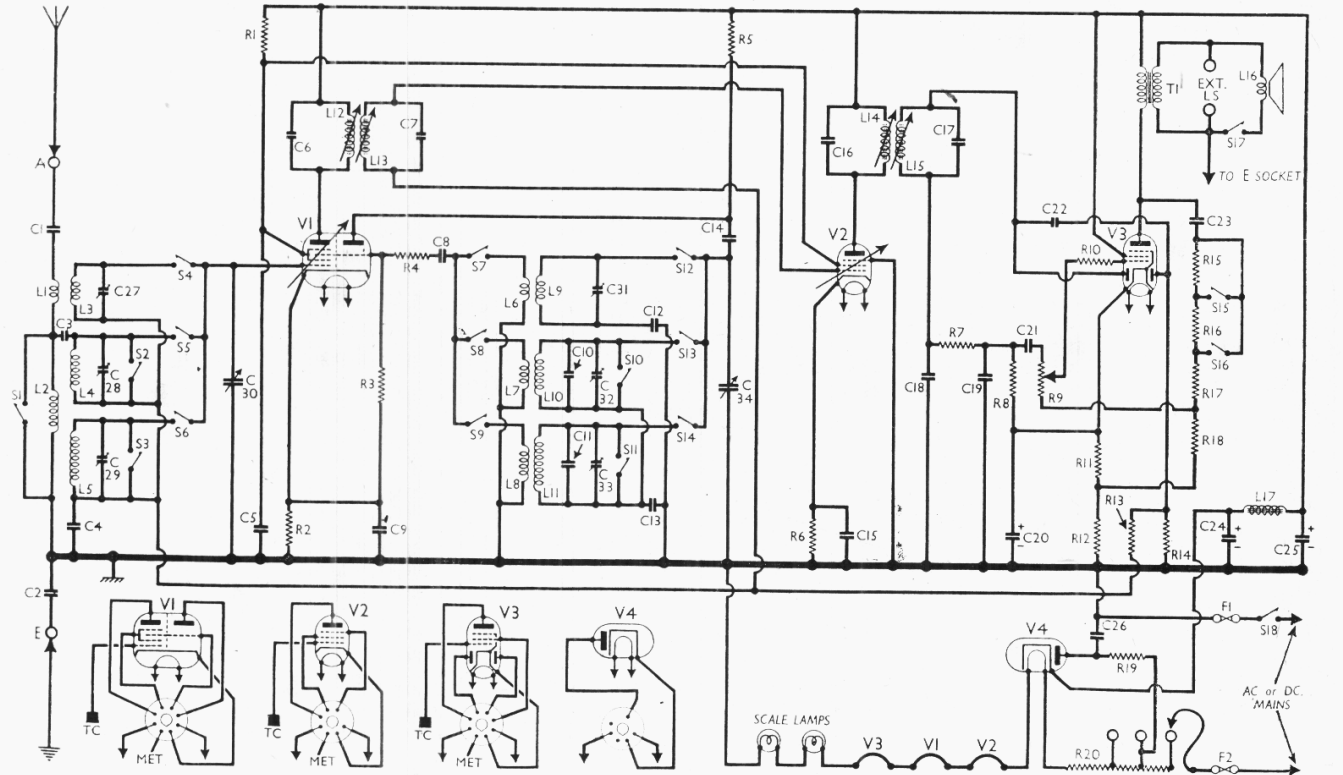
### COMPONENTS AND VALUES

RESISTORS	Values (ohms)	
R1	V1, V2 S.G.'s H.T. feed ...	47,000
R2	V1 fixed G.B. resistor ...	150
R3	V1 osc. C.G. resistor ...	47,000
R4	V1 osc. reaction stabilizer ...	47
R5	V2 fixed anode H.T. feed ...	47,000
R6	V2 fixed G.B. resistor ...	220
R7	I.F. stopper ...	47,000
R8	V3 signal diode load ...	470,000
R9	Manual volume control ...	1,000,000
R10	V3 pent. grid stopper ...	100,000
R11	V3 pent. G.B. and A.V.C. {	150
R12	delay resistors ... {	330
R13	A.V.C. line decoupling ...	1,000,000
R14	V3 A.V.C. diode load ...	1,000,000
R15	Tone control resistors ... {	100,000
R16	{	47,000
R17	Feed-back potential divi- {	15,000
R18	der ... {	4,700
R19	V4 anode surge limiter ...	100
R20	Heater ballast resistor ...	820*

CAPACITORS		Values ( $\mu$ F)
C1	Aerial isolator ...	0-0003
C2	Earth isolator ...	0-05
C3	Aerial M.W. "top" coupling ...	0-000006
C4	A.V.C. line decoupling ...	0-1
C5	V1, V2 S.G.'s decoupling ...	0-1
C6	1st I.F. transformer tuning {	0-00007
C7	capacitors ... {	0-00007
C8	V1 osc. C.G. capacitor ...	0-00015
C9	V1 cathode by-pass ...	0-1
C10	Osc. M.W. fixed trimmer ...	0-000022
C11	Osc. L.W. fixed trimmer ...	0-00034
C12	Osc. circ. S.W. trimmer ...	0-005
C13	Osc. M.W. and L.W. tracker ...	0-000657
C14	V1 osc. anode coupling ...	0-00015
C15	V2 cathode by-pass ...	0-1
C16	2nd I.F. transformer tuning {	0-00014
C17	capacitors ... {	0-00014
C18	I.F. by-pass capacitors ... {	0-00015
C19	{	0-00015
C20*	V3 cathode by-pass ...	25-0
C21	A.F. coupling to V3 pent. ...	0-005
C22	V3 A.V.C. diode coupling ...	0-000022
C23	Neg. feed-back coupling ...	0-01
C24*	{	16-0
C25*	H.T. smoothing capacitors ... {	24-0
C26	Mains R.F. by-pass ...	0-1
C27†	Aerial circ. S.W. trimmer ...	0-00003
C28‡	Aerial circ. M.W. trimmer ...	0-00003
C29‡	Aerial circ. L.W. trimmer ...	0-00003
C30†	Aerial circuit tuning ...	§0-000532
C31†	Osc. circ. S.W. trimmer ...	0-00003
C32†	Osc. circ. M.W. trimmer ...	0-00003
C33†	Osc. circ. L.W. trimmer ...	0-00003
C34†	Oscillator circuit tuning ...	§0-000532

\* Tapped at 620 $\Omega$  + 100 $\Omega$  + 100 $\Omega$  from V4 heater.

\* Electrolytic. † Variable. ‡ Pre-set. § "Swing" value, min. to max.



Circuit diagram of the Invicta Model 60 A.C./D.C. 3-band superhet. The speech coil circuit is connected directly to the E socket.

OTHER COMPONENTS		Approx. Values (ohms)
L1	Aerial S.W. coupling coil ...	0.2
L2	Aerial M.W. and L.W. coupling coil ...	65.0
L3	Aerial S.W. tuning coil ...	Very low
L4	Aerial M.W. tuning coil ...	3.7
L5	Aerial L.W. tuning coil ...	12.8
L6	Osc. S.W. reaction coil ...	10.8
L7	Osc. M.W. reaction coil ...	1.2
L8	Osc. L.W. reaction coil ...	1.6
L9	Osc. S.W. tuning coil ...	Very low
L10	Osc. M.W. tuning coil ...	1.7
L11	Osc. L.W. tuning coil ...	2.3
L12	1st I.F. trans. { Pri. ...	8.5
L13		Sec. ...
L14	2nd I.F. trans. { Pri. ...	6.0
L15		Sec. ...
L16	Speaker speech coil ...	2.8
L17	H.T. smoothing choke ...	330.0
T1	Output trans. { Pri. ...	250.0
	Sec. ...	0.4
S1-S14	Waveband switches ...	—
S15, S16	Tone control switches ...	—
S17	Mains switch, ganged R9 ...	—
F1, F2	Mains fuses—1.0A ...	—

### VALVE ANALYSIS

Valve voltages and currents given in the table below are those quoted by the manufacturers. Their receiver was operating on A.C. mains of 200 V, using the 200-210 V tapping on the heater ballast resistor, and voltages were measured with a 1,000 ohms-per-volt meter, chassis being the negative connection.

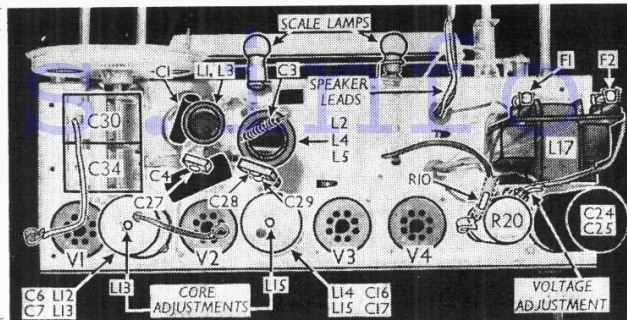
Valve	Anode Voltage (V)	Anode Current (mA)	Screen Voltage (V)	Screen Current (mA)
V1 CCH35	190	2.0	60	1.9
	Oscillator	62		
V2 EF39	190	4.0	60	3.0
V3 CBL31	180	37.0	190	3.0
V4 CY31†	—	—	—	—

Cathode to chassis, 210 V, D.C.

### DISMANTLING THE SET

**Removing Chassis.**—Remove the two round control knobs (recessed grub screws) and the two bar knobs (pull off); remove the insulating covers from the heads of the chassis retaining screws on the underside of the cabinet; remove the four screws (with steel washers, rubber grommets, and brass sleeves) holding the chassis to the base of the cabinet, when the chassis may be withdrawn to the extent of the speaker leads. To free the chassis entirely, unsolder from the connecting panel on the speaker the two leads joining it to chassis. When replacing, two of the specially shaped rubber grommets should be fitted to each

Plan view of the chassis. C<sub>3</sub> is a very small capacitor made of enamelled wires. R<sub>10</sub> is mounted on the top cap connector of V<sub>3</sub>.



chassis bolt, one going each side of the base of the cabinet, with a brass distance piece between them; a flat steel washer fits beneath the head of each screw. Do not omit to replace the insulating covers on the heads of the four chassis retaining screws. **Removing Speaker.**—Loosen the nuts on the four speaker retaining clamps. When replacing, the connecting panel should be at the top and a rubber packing piece should be inserted between each fixing clamp and the speaker chassis.

### GENERAL NOTES

**Switches.**—S1—S14 are the waveband switches, ganged in two rotary units beneath the chassis. The units are indicated in our under-chassis view, and shown in detail in the diagrams on the right of that illustration, where they are drawn as seen from the rear of an inverted chassis.

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

S15, S16 are the tone control switches, in a further rotary unit beneath the chassis. The three positions, starting from the fully anti-clockwise position of the control, are: Mellow (S16 closed); Normal (S15 closed); and Brilliance (both switches open).

**External Speaker.**—Two sockets are provided at the rear of the chassis for the connection of a low impedance (2-3 Ω) external speaker.

**Scale Lamps.**—These are two M.E.S. type lamps, with large, clear, spherical bulbs, rated at 6.2 V, 0.3 A.

**Fuses F1, F2.**—These are standard tubular types, rated at 1 A, 1 1/2 inches long.

**Alternative Valves.**—V1 may be an ECH35, when its heater would be wired between fuse F1 and chassis because it is rated at 0.3 A.

V3 may be a Mazda Pen DD 4020, with a 7-pin base. The anode current will then be 27.0 mA, and the screen current 6.0 mA.

**Drive Cord Replacement.** This requires 50 inches of cord (Cutty Ilunk fishing twine will do) which should be fitted as shown in the sketch inset beneath the circuit diagram of the Invicta model 10, on Service Sheet 801. Space is not available for it here.

### CIRCUIT ALIGNMENT

**I.F. Stages.**—Connect signal generator leads via a 0.1 μF capacitor to control grid (top cap) of V1 and chassis, and connect a 100,000 Ω resistor also between these points. Feed in a 465 kc/s (645.16 m) signal, and adjust the cores of L12, L13, L14 and L15 for maximum output. A slotted cobalt rod makes a suitable trimming tool. Remove shunt and capacitor.

**R.F. and Oscillator Stages.**—Transfer signal generator leads to A and E sockets, via a suitable dummy aerial. The pointer should coincide with the ends of the three scales when the gang is at maximum. It may be adjusted while in the cabinet at the high wavelength end of the scales if the drive drum fixing screw is slackened.

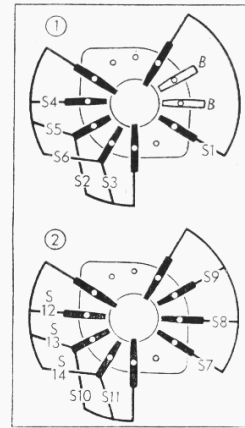
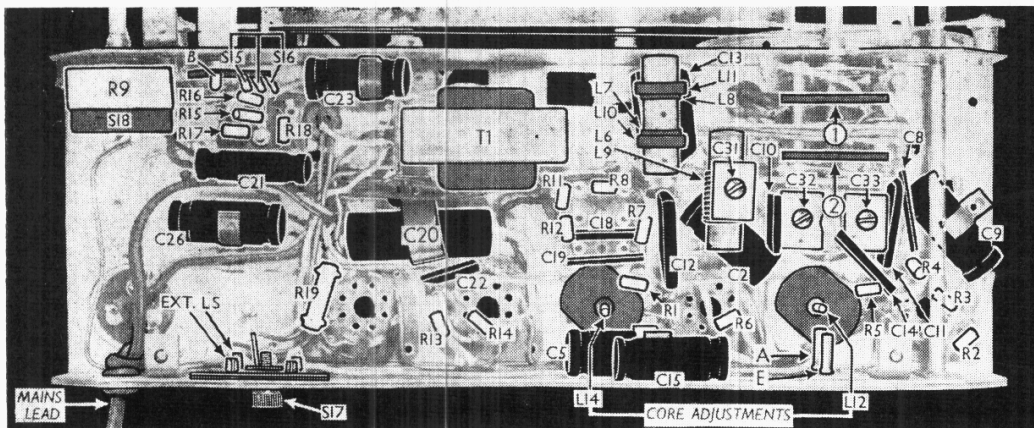
**M.W.**—Switch set to M.W., tune to 200 m on scale, feed in a 200 m (1,500 kc/s) signal, and adjust C32, then C28, for maximum output. Check calibration at 500 m (600 kc/s).

**L.W.**—Switch set to L.W., tune to 1,200 m on scale, feed in a 1,200 m (250 kc/s) signal, and adjust C33, then C29, for maximum output. Check calibration at 2,000 m (150 kc/s).

**S.W.**—Switch set to S.W., tune to 14 m on scale, feed in a 14 m (21.43 Mc/s) signal, and adjust C31, then C27, for maximum output. Check calibration at 50 m (6.0 Mc/s).

### Waveband Switch Table

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



Under-chassis view. 1 and 2 in circles indicate the waveband switch units, shown in detail in the diagrams on the right.