'TRADER' SERVICE SHEET 271

INVICTA 360

3-VALVE A.C. SUPERHET

THE Invicta 360 is a 3-valve (plus rectifier) A.C. 2-band superhet for mains of 200-250 V, 40-100 C/S. It has provision for an extension speaker and for using the mains as an aerial, and there is a plug and socket tone control at the back of the chassis.

CIRCUIT DESCRIPTION

Aerial input via coupling coil **L1** and small condenser **C1** to single tuned circuit **L2, C16** (M.W.), plus **L3** (L.W.), which precedes triode hexode valve (**V1, Mullard metallised TH4** or octode **FC4**). Oscillator grid coils **L4** (M.W.), plus **L5** (L.W.) are tuned by **C18**; parallel trimming by **C19** (M.W.) and **C20** (L.W.); tracking by specially shaped vanes of **C18.** Oscillator anode reaction by coil **L6** on both bands.

Second valve (**V2, Mullard metallised VP4B**) is a variable-mu R.F. pentode operating as intermediate frequency amplifier with tuned-primary tuned-secondary transformer couplings **C21, L7, L8, C22** and **C23, L9, L10, C24.**

Intermediate frequency 465 KC/S.

Diode second detector is part of double diode pentode output valve (**V3, Mullard Pen4DD**). Audio frequency component in rectified output is developed across load resistance **R7** and passed via A.F. coupling condenser **C9** and manual volume control **R6** to C.G. of pentode section. I.F. filtering by **C7, C8** and **R5.** Two-position tone control by **C11, R12** in anode circuit, desired position being obtained by insertion or removal of plug "X" on flying lead which, with its appropriate socket, makes or breaks the junction between the two components of the filter. Provision for connection of low impedance external speaker across secondary of output transformer **T1.**

Second diode of **V3,** fed via **C10** from **L10,** provides D.C. potential which is developed across load resistance **R11** and fed back through decoupling circuit to F.C. and I.F. valves, giving automatic volume control. Delay voltage is obtained from drop along resistances **R8, R9** in **V3** cathode circuit.

H.T. current is supplied by full-wave rectifying valve (**V4, Mullard DW4/350**). Smoothing by speaker field **L13** and dry electrolytic condensers **C13** and **C14.** Mains aerial coupling by **C15.**

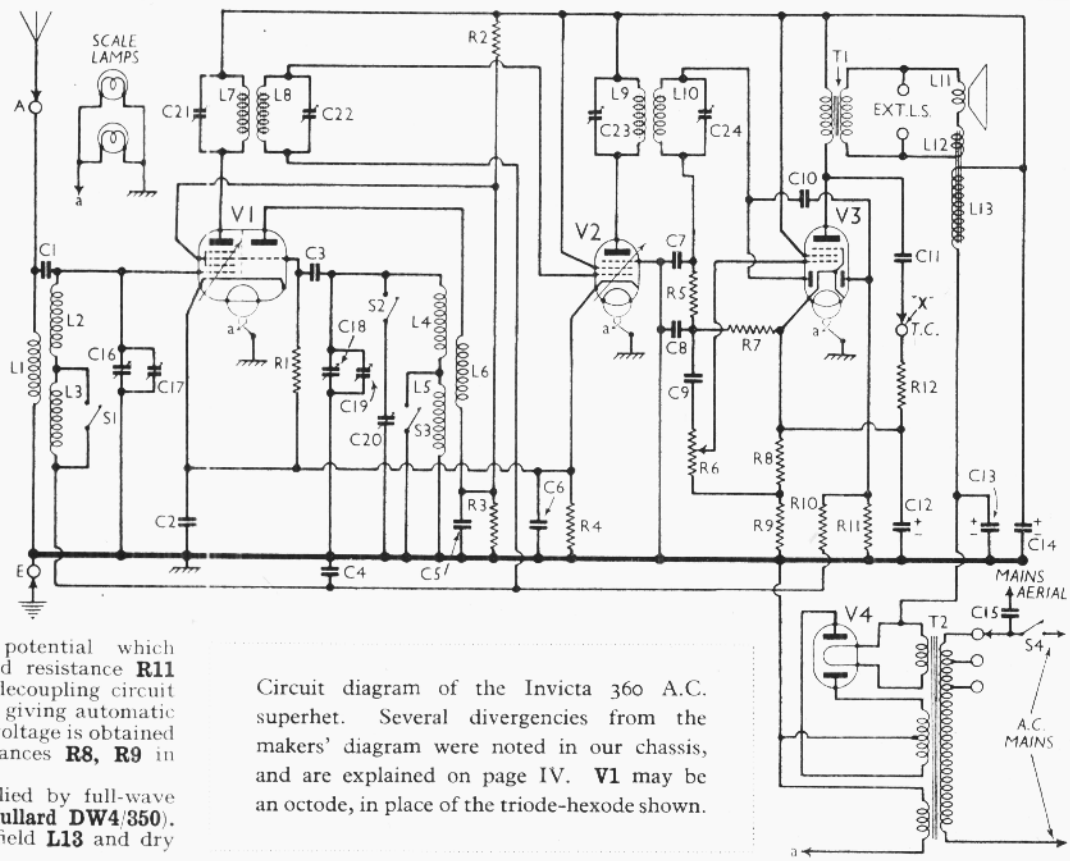
COMPONENTS AND VALUES

	CONDENSERS	Values (μF)
C1	Aerial coupling condenser	—
C2	Part V1, V2 cathodes by-pass	0·1
C3	V1 osc. C.G. condenser	0·00015
C4	A.V.C. line decoupling	0·1
C5	V1 osc. anode and S.G. R.F. by-pass	0·1
C6	Part V1, V2 cathodes by-pass	0·25
C7	I.F. by-passes	0·00015
C8		0·00015
C9	A.F. coupling to V3 pentode	0·05
C10	Coupling to V3 A.V.C. diode	0·00015
C11	Part T.C. filter circuit	0·01
C12*	V3 cathode by-pass	20·0
C13*	H.T. smoothing	8·0
C14*		8·0
C15	Mains aerial coupling	0·001
C16	Aerial circuit tuning	0·00054
C17	Aerial circuit M.W. trimmer	—
C18	Oscillator circuit tuning	—
C19	Osc. circuit M.W. trimmer	—
C20	Osc. circuit L.W. trimmer	0·00023
C21	1st I.F. trans. pri. tuning	0·00009
C22	1st I.F. trans. sec. tuning	0·00009
C23	2nd I.F. trans. pri. tuning	0·00014
C24	2nd I.F. trans. sec. tuning	0·00014

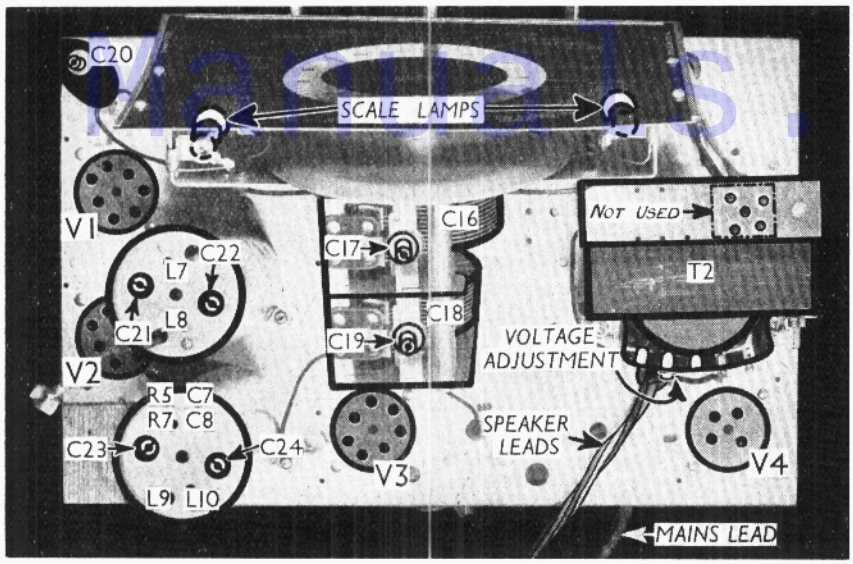
* Electrolytic.

	RESISTANCES	Values (ohms)
R1	V1 osc. G.C. resistance	40,000
R2	V1 osc. anode and S.G. H.T. feed potentiometer	20,000 – 60,000
R3		
R4	V1, V2 fixed G.B. resistance	50
R5	I.F. stopper	100,000
R6	Manual volume control	500,000
R7	V3 signal diode load	500,000
R8	V3 triode G.B. and A.V.C. delay voltage resistances	150 – 150
R9		
R10	A.V.C. line decoupling	1,000,000
R11	V3 A.V.C. diode load	1,000,000
R12	Part T.C. filter circuit	100

	OTHER COMPONENTS	Approx. Values (ohms)
L1	Aerial coupling coil	65·0
L2	Aerial M.W. tuning coil	2·6
L3	Aerial L.W. tuning coil	11·4
L4	Osc. circuit M.W. tuning	1·9
L5	Osc. circuit L.W. tuning	0·9
L6	Oscillator reaction coil	60·0
L7	1st I.F. trans. Pri.	6·5
L8	1st I.F. trans. Sec.	3·5
L9	2nd I.F. trans. Pri.	3·5
L10	2nd I.F. trans. Sec.	3·5
L11	Speaker speech coil	1·75
L12	Hum neutralising coil	0·2



Circuit diagram of the Invicta 360 A.C. superhet. Several divergencies from the makers' diagram were noted in our chassis, and are explained on page IV. **V1** may be an octode, in place of the triode-hexode shown.



Plain view of the chassis. **R5, R7, C7** and **C8** are inside the **L9, L10** I.F. unit. The valveholder not used is in parallel with the **V4** holder.

	OTHER COMPONENTS (*Continued*)	Approx. Values (ohms)
L13	Speaker field coil	3,000·0
T1	Output trans. { Pri. ..	320·0
	Sec... ..	0·2
T2	Mains trans. { Pri., total ..	23·0
	Heater sec. ..	0·1
	Rect. heat. sec.	0·15
	H.T. sec., total	620·0
S1-S3	Waveband switches	—
S4	Mains switch, ganged R6 ..	—

DISMANTLING THE SET

Removing Chassis.—If it is desired to remove the chassis from the cabinet, remove the three control knobs (recessed grub screws) and the felt washers from the spindles, and remove the four bolts (with washers) holding the chassis to the platform.

The chassis can now be withdrawn to the extent of the speaker leads, which is sufficient for normal purposes. *When replacing*, do not forget to replace the felt washers on the control spindles.

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

Removing Speaker.—The speaker can only be removed from the cabinet by removing the sub-baffle first, this being carried out by removing the four wooden wedges (eight countersunk-head wood screws). The speaker can now be removed from the sub-baffle by removing the nuts from the four screws holding it. *When replacing*, see that the terminal panel is on the right.

VALVE ANALYSIS

Valve voltages and currents given in the table (col. 2) are those measured in our receiver when it was operating on mains of 227 V, using the 210-235 V tapping 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.

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

Valve	Anode Voltage (V)	Anode Current (mA)	Screen Voltage (V)	Screen Current (mA)
V1 TH4	{ 178 Oscillator 45	2·1 1·4	45	3·8
V2 VP4B	178	10·0	178	3·5
V3 Pen4DD	168	26·0	178	4·4
V4 DW4/350	315†	—	—	—

† Each anode, A.C.

GENERAL NOTES

Switches.—**S1-S3** are the wavechange switches, ganged together in a unit beneath the chassis. The individual switches are indicated in our under-chassis view.

In the M.W. position **S1** and **S3** are closed, and **S2** open, and in the L.W. position, **S2** is closed and **S1** and **S3** open.

S4 is the Q.M.B. mains switch, ganged with the volume control, **R6**.

Coils. L1-L3 and **L4-L6** are in two unscreened units beneath the chassis. The individual coils are indicated in our under-chassis view. The I.F. transformers **L7, L8** and **L9, L10** are in two screened units on the chassis deck, with their associated trimmers. The second unit also contains **R5, R7** and **C7, C8.**

Scale Lamps.—These are two Ever Ready M.E.S. types, rated at 6.2 V, 0.3 A.

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

Tone Control.—A plug on a flying lead (marked **X** in our diagram) emerges from the rear of the chassis, and when plugged into the socket marked **TC** connects **C11** to the top end of **R12,** thus introducing high note attenuation. Maximum treble is secured by leaving the plug and flying lead loose.

Mains Aerial.—When this is not in use, the plug should be placed in the socket marked **A2,** which is actually connected to chassis, and is not shown in our circuit diagram.

V4 Holder.—This is fitted, as usual, on the chassis deck, but in our chassis there is another holder, in parallel with it, on a paxolin strip mounted above **T2.** This is not used in this set, but the sockets form convenient " bearers " for leads from **T2.**

Condensers C13, C14.—These are two 8 μF dry electrolytics in a single carton beneath the chassis, with a common negative (black) lead. The red lead to **V4** valveholder is the positive of **C13,** and the red lead to one of the tags on the insulated " bearer plate," fitted to the underside of the chassis, is the positive of **C14.**

Trimmers.—Apart from **C17** and **C19** on the gang condenser, the only other trimmer is **C20,** mounted at one corner of the chassis deck.

Condenser C1.—This is a small fixed condenser formed of enamelled wire

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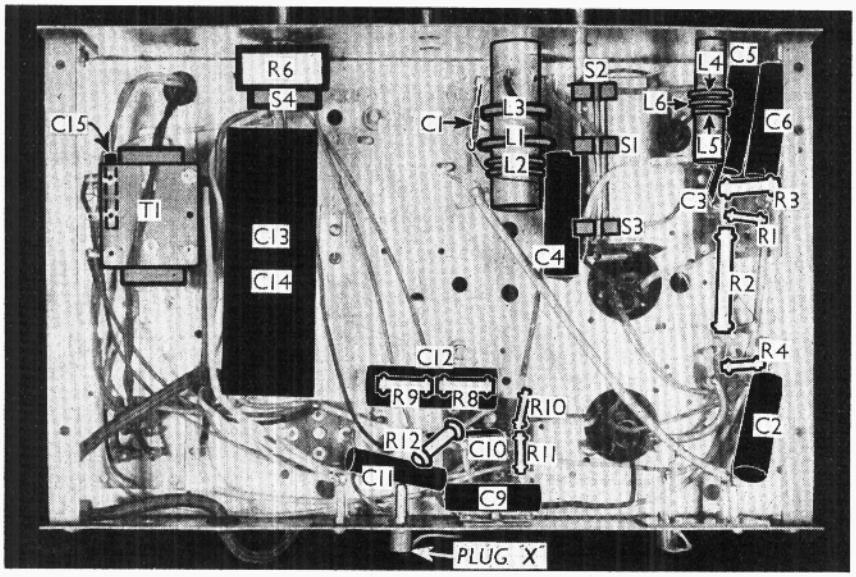

Under-chassis view. **C1** is a small fixed condenser and **X** is the tone control plug.

MAINTENANCE PROBLEMS

Hints Contributed by Service Engineers

Solder Causes Intermittent Fault

AN H.M.V. radiogram recently brought in for service gave intermittent performance, and when the volume control was fully advanced and retarded terrific noises could be heard, the signal in the meantime varying from practically zero to full volume. A faulty volume control was suspected.

The set was dismantled and the control subsequently found to be perfect, but it was noticed that on turning the chassis upside down signals disappeared completely, except for faint noises from the local stations.

During further testing the coils were suspected, but were found to be in order. After some further tests it was found that a blob of solder had been allowed to travel down the soldering tag on one of the banks of fixed vanes of the gang condenser and had spread itself outwards, causing a short circuit to the metal frame of the condenser.

Underneath the solder was a film of flux which caused the solder to short circuit the tuning condenser intermittently.

It will be noted that signals did not completely disappear; this may be because of the 0.1 μF condenser placed in series with the tuning condenser.—D. J. MOSES, PORTHCAWL.

Damaged I.F. Transformers

RECENTLY a Marconi 219 was brought in for service. The customer, new to us, reported poor performance and often no results whatever. He said it had been back to the dealer and to the works several times.

The output stage was O.K. and so were all the valves. All the trimmer seals had been broken. A signal of 125 KC/S was injected into the I.F. valve, but only violent "clicks" were seen on the C.R. tube. With the trackers screwed in a faint response was noted at about 180 KC/S. The receiver had evidently been lined up at this (incorrect) I.F.! Medium waves tuned fairly well, but the output was badly down. With any slight shift of the tracker screws, there was a click, and the signals were gone.

We assumed broken or shorting trackers, so dismantled the I.F. coils. The trackers were O.K., but the screws had been taken so far in that they had "channelled" both I.F. coils! Many turns were broken and shorted by the screw threads. The screws were still some way from being turned flush with the can, and yet they had fouled the coils.

Placing the coils $\frac{1}{4}$ in. further along the coil former would have prevented this. This, however, is no excuse for the "service engineer," who probably thought the screws were not tight enough.—G. C. OXLEY, TIBSHELF.

Interference in Philco 444

WE have found that in many cases severe interference on the long wave band of the Philco 444 receiver is due to the frequency changer valve (6A7) generating oscillations at approximately 6 to 7 metres.

The effect of this is manifested in the set receiving severe interference from motor car ignition systems. The cure will invariably be found by earthing the two brushes on the moving vanes of the twin gang tuning condenser.

They should be earthed with the shortest possible flexible leads to the chassis immediately below the condenser.—R. G. POOLE, SHIPLEY.

Intermittent Short in Transformer

AN A.C. superhet was in for repair, and was found on test to be absolutely silent, while the output pentode was observed to be overheating. Resistance tests were commenced, and the mains transformer windings showed correct values. The speaker field coil was in the H.T. negative line between the centre tap of the H.T. secondary and earth.

Systematic tests of all components likely to cause the trouble, including mains transformer inter-winding tests with a megger, revealed no fault.

A fault causing a short circuit of the L.S. field was suspected, as the output valve had run hot and no sound was heard in the speaker. As a check on this assumption the receiver was switched on again for a short period and when the output valve was seen to be overheating, one of the field plugs was removed from its socket.

The valve continued to overheat, and it was now obvious that the short was between the H.T. secondary winding and earth. On switching off the set and making a resistance test a short was revealed between the centre tap and earth even with the field coil disconnected.

On applying pressure to the transformer secondary winding while still warm it was possible to produce or clear the fault at will.

Further tests when the windings were cold revealed no fault. Finally it was found that a short existed between the H.T. secondary and one of the heater windings, which only appeared when the transformer was warm.—W. G. GOUGH, WORCESTER.

Loose Bearings in Condenser

THE customer complained of lack of selectivity in a receiver, and knowing aerial and earth conditions to be reasonable I naturally suspected faulty ganging.

However, as a preliminary, the set was switched on and the dial rotated through a number of stations to check calibration. Everything seemed normal, until the high-frequency end of the scale was approached, when I "overshot" a transmission, and turned the dial back to get it again.

The station came in five degrees higher up the scale! Obviously, a slipping dial, I thought, but examination proved me wrong.

Some amount of puzzling, and a careful examination of the condenser gang, showed that it had a small amount of side play, which varied according to the direction in which the gang was driven, and so varied the capacity for a given dial setting.

A half-turn on the cupped bearing screw at the rear of the gang condenser assembly put matters right.—L. P. DISMORE, MALTA.

INVICTA 360—*Continued*

spiralled over a straight insulated wire, and is mounted on the **L1-L3** coil unit.

Valve V3.—The connections of the Pen4DD differ from standard. The valve has a 7-pin base, but the anode and cathode are interchanged, pin 2 being cathode, and pin 6, anode.

Chassis Divergencies.—Our chassis differed in a number of points from the makers' diagram supplied, which was evidently an early one.

In the first place, the tone control circuit **C11, R12** and plug **X** was not shown. **C10** was shown connected from A.V.C. diode to anode of **V2,** not to detector diode, and its value was 0.00001 μF, not 0.00015 μF, as in our chassis.

C1, C17 and **C19** were not shown on the makers' diagram. In the makers' diagram, one side of each receiving valve heater was not taken to chassis. **C2** in our chassis was 0.1 μF, not 0.2 μF, while an additional condenser (**C6,** 0.25 μF) was found in parallel with this.

R4 was shown as 100 O, not 50 O as in our chassis, and **R9** was shown as 300 O, not 150 O. The secondary of **T1** was shown with one side connected to chassis, but this was not so in our set. **V1** may be an octode, not a triode-hexode.

CIRCUIT ALIGNMENT

I.F. Stages.—Connect signal generator between grid (top cap) of **V1** and chassis. Feed in a 465 KC/S signal, and adjust **C24, C23, C22** and **C21** in that order for maximum output.

R.F. and Oscillator Stages.—With gang at maximum, see that scale pointer is horizontal. Switch set to M.W., connect signal generator to **A** and **E** sockets, feed in a 250 m. signal, tune to 250 m. on scale, and adjust **C19,** then **C17,** for maximum output, keeping input low. Switch set to L.W., tune to 1,200 m. on scale, feed in a 1,200 m. signal, and adjust **C20** for maximum output, rocking the gang slightly for optimum results.