NUMBER SIXTY-ONE **'TRADER' SERVICE SHEETS**

AERODYNE 'SILVER WING'

A.C. SUPERHET

IN the Aerodyne " Silver Wing " A.C. superhet a 4-valve (plus valve rectifier) circuit is employed, the frequency changer being an octode (or, alternatively, a heptode). A separate double diode is used for second detection and A.V.C.

CIRCUIT DESCRIPTION

Two alternative aerial connections (one, **A2,** via fixed series condenser **C1**) to coupling coils **L1, L2.** Capacity coupled band-pass input filter :—Primary **L3, L4** tuned by **C19** ; secondary **L5, L6** tuned by **C21** ; top coupling by **C31** ; bottom coupling by **C2.**

First valve (**V1, Mullard metallised FC4**) is an octode operating as frequency changer with electron coupling. Oscillator grid tuning coils **L7, L8,** tuned by **C23** ; anode reaction coil **L9** ; tracking condensers **C5** (M.W.) and **C25** (L.W.).

Second valve, a variable-mu H.F. pentode (**V2, Mullard metallised VP4B**) operates as intermediate frequency amplifier with tuned-primary tuned-secondary transformer couplings **L10, L11** and **L12, L13.**

Intermediate frequency 125 KC/S.

Diode second detector forms part of double diode valve (**V3, Mullard metallised 2D4A**). Second diode, fed from **V2** anode by **C11** provides D.C. potential which is developed across load resistances **R9, R10** and fed back through decoupling circuits as G.B. to F.C. and I.F. valves, giving automatic volume control. Delay voltage is obtained from drop along **R13, R14** in **V4** cathode circuit. Voltage drop along **R13** also provides slight negative bias which is applied to rectifier diode in order to give a degree of inter-station noise suppression.

Audio frequency component in output from rectifier diode is developed across **R7,** and passed via coupling condenser **C10,** manual volume control **R11,** and I.F. stopper **R12** to control grid of output pentode (**V4, Mullard Pen 4VB**). Provision for connection of gramophone pick-up in grid circuit. Tone compensation in anode circuit by fixed condenser **C12** ; variable tone control by filter **R15, C13.**

H.T. current is supplied by full-wave rectifying valve (**V5, Micromesh or Brimar R3**). Smoothing by speaker field winding **L16** and dry electrolytic condensers **C15** and **C17.** Mains aerial connection by condenser **C18.**

DISMANTLING THE SET

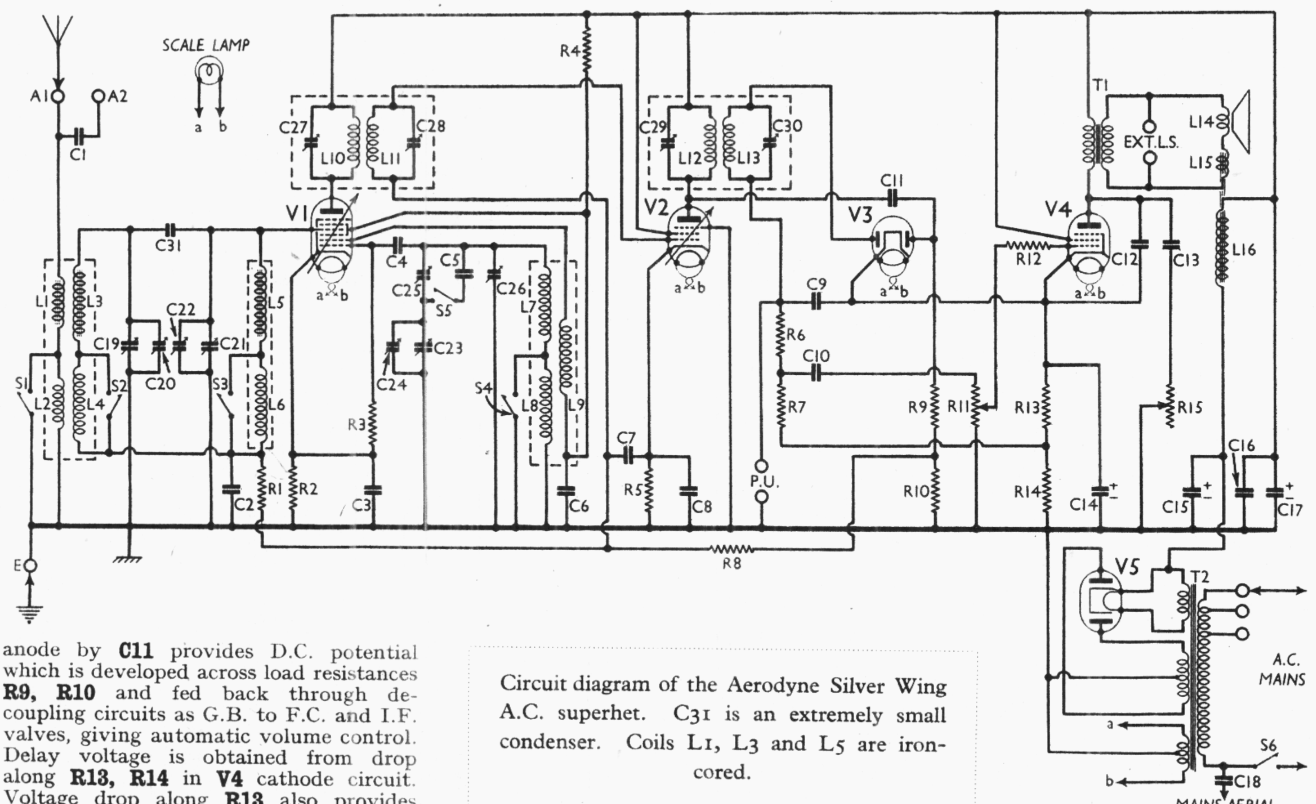
Removing Chassis.—Remove back (seven wood screws and washers) and the four control knobs (pull off). Remove the four bolts holding chassis, heads underneath cabinet. Three of these have rubber washers and large metal washers, while the fourth has a metal washer only. *When replacing,* note that this last goes in hole recessed in cabinet bottom. Remove two wood screws holding tuning dial to cabinet front.

Chassis can now be withdrawn and there is sufficient slack on speaker leads to enable normal repairs to be effected. To remove chassis entirely, unsolder leads on speaker terminal panel. *When replacing,* leads should be connected as follows, numbering tags from top to bottom with transformer on right :—1, black ; 2, blue ; 3 and 4 joined together, red.

Removing Speaker.—Speaker may be removed by freeing sub-baffle (three wood screws). *When replacing,* note that transformer should point to bottom right-hand corner of cabinet. If it is desired to free speaker entirely, the three clamps should be slackened off and the wood screw (with washer) on the left removed.

COMPONENTS AND VALUES

	Resistances	Values (ohms)
R1	V1 pent. cont. grid decoupling	500,000
R2	V1 fixed G.B. resistance ..	250
R3	V1 osc. grid resistance ..	50,000
R4	V1 S.G.'s and osc. anode decoupling	15,000
R5	V2 fixed G.B. resistance ..	100
R6	I.F. stopper	50,000
R7	V3 rect. diode load	1,000,000
R8	A.V.C. circuit decoupling ..	1,000,000
R9	} V3 A.V.C. diode load ..	{ 1,000,000
R10		300,000
R11	Manual volume control ..	500,000
R12	V4 grid I.F. stopper ..	50,000
R13	} V4 auto G.B. and A.V.C.	{ 40
R14	delay voltage resistances	100
R15	Variable tone control	50,000

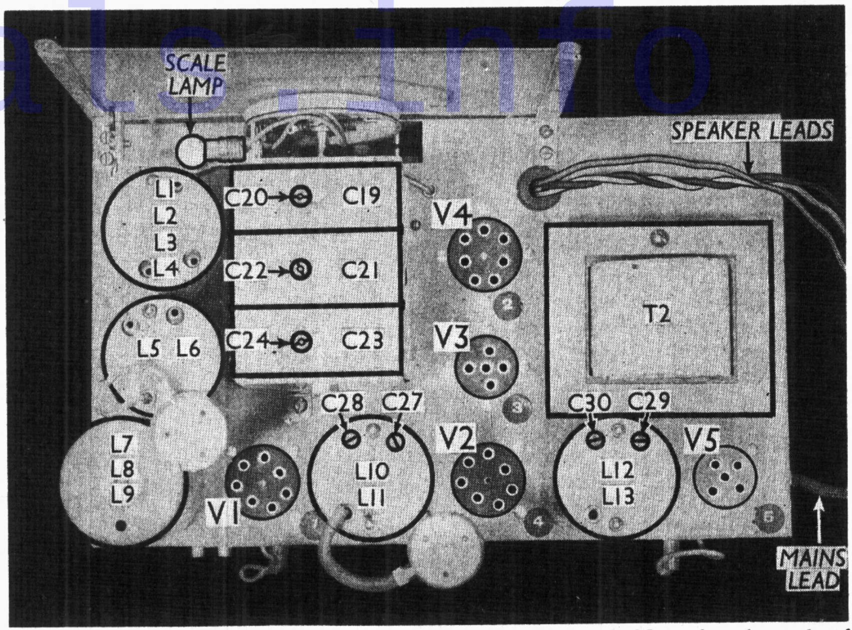


Circuit diagram of the Aerodyne Silver Wing A.C. superhet. C31 is an extremely small condenser. Coils L1, L3 and L5 are iron-cored.

	Condensers	Values (μF)
C1	Aerial series condenser	0·00005
C2	Band-pass coupling	0·05
C3	V1 cathode by-pass	0·1
C4	V1 osc. grid condenser ..	0·0005
C5	V1 osc. M.W. tracker ..	0·0013
C6	V1 S.G.'s and osc. anode decoupling	0·1
C7	V2 cont. grid decoupling ..	0·02
C8	V2 cathode by-pass	0·1
C9	I.F. by-pass	0·0001
C10	L.F. coupling to V4	0·002
C11	Coupling to V3 A.V.C. diode..	0·00005
C12	Fixed tone compensator ..	0·001
C13	Part of variable tone control..	0·02
C14*	V4 cathode by-pass	25·0
C15*	H.T. smoothing ..	8·0
C16		0·1
C17*		8·0
C18	Mains aerial condenser ..	0·0002
C19	Band-pass primary tuning ..	0·0005
C20‡	Band-pass primary trimmer ..	—
C21	Band-pass secondary tuning ..	0·0005
C22‡	Band-pass secondary trimmer	—
C23	Oscillator tuning	0·0005
C24‡	Oscillator main trimmer ..	—
C25‡	Oscillator L.W. tracker ..	0·0008
C26‡	Oscillator M.W. trimmer ..	0·00005
C27‡	1st I.F. trans. pri. tuning ..	0·00014
C28‡	1st I.F. trans. sec. tuning ..	0·00007
C29‡	2nd I.F. trans. pri. tuning ..	0·00007
C30‡	2nd I.F. trans. sec. tuning ..	0·00014
C31†	Band-pass top coupling ..	Very low

* Electrolytic. ‡ Pre-set.
† Formed by crossed wires.

	Other Components		Values (ohms)
L1	Aerial coupling coils ..		0·25
L2			34·0
L3	Band-pass primary coils		1·1
L4			13·0
L5	Band-pass secondary coils		1·1
L6			13·0
L7	Oscillator tuning coils..		2·8
L8			9·0
L9	Oscillator anode coils		1·6
L10	1st I.F. trans.	Pri.	55·0
L11		Sec.	100·0
L12	2nd I.F. trans... ..	Pri.	100·0
L13		Sec.	55·0
L14	Speaker speech coil		1·7
L15	Hum neutralising coil.. ..		0·1
L16	Speaker field winding.. ..		1500·0
T1	Speaker input trans ..	Pri.	560·0
		Sec.	0·2



Plan view of the chassis. The layout is quite straightforward. Note that the makers' valve numbering on the chassis is not the same as the numbering in the circuit, V2 and V4 being transposed.

	Other Components (*Cont.*)		Values (ohms)
T2	Mains transformer	Pri. total ..	23·0
		Heater sec. ..	0·03
		Rect. heat. sec.	0·05
		H.T. sec. ..	420·0
S1-S5	Waveband switches		—
S6	Mains switch, ganged R11 ..		—

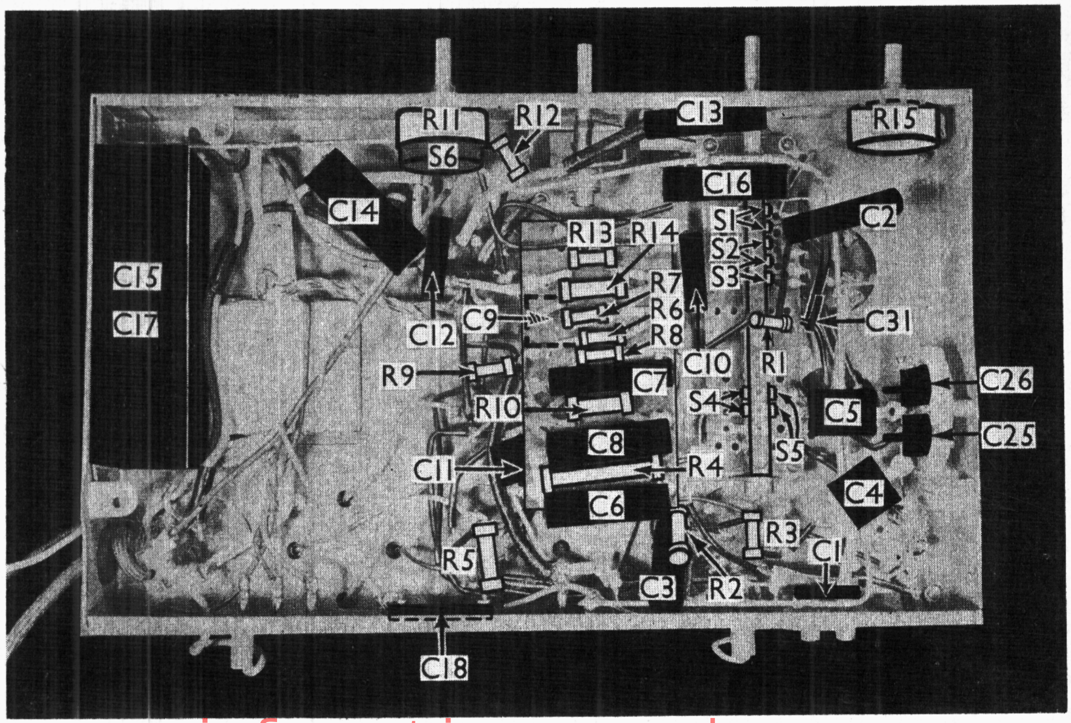
VALVE ANALYSIS

Voltages and currents given in the valve table below are those given by Aerodyne for an average chassis with no signal input. Voltages were measured with a high resistance meter, with chassis as negative.

Valve	Anode Volts	Anode Current (mA)	Screen Volts	Screen Current (mA)
V1 FC4* ..	240	1·5	97	2·9
V2 VP4B ..	240	6·0	97	2·7
V3 2D4A ..	—	—	—	—
V4 Pen4VB	227	27·0	240	5·0
V5 R3† ..	250	—	—	—

* Osc. anode (G2) 131V, 4·7 mA.
† Each anode, A.C.

(*Continued overleaf*)



Under-chassis view. C31 is formed of a loop of wire. S2 and S3 each have one common contact. C25 and C26 are adjusted through holes in the side of the chassis. C9 is beneath the paxolin component panel.

AERODYNE 'SILVER WING' (*contd.*)

GENERAL NOTES

Switches.—**S1-S5** are ganged in a single unit, and are indicated in the under-chassis view. Note that **S2** and **S3** each have one common fixed contact, also that there is a fixed contact next to **S4**, which is not used. All these switches are closed on the M.W. band and open on the L.W. band.

S6 is the Q.M.B. mains switch, ganged with **R11.**

Coils.—These are in five screened units, three for the signal frequency and oscillator coils, and two for the I.F. transformers. The screens are each held to the chassis by two studs, with nuts beneath the chassis deck. To remove the screens without the coils, the domed nuts at the top of each screen must also be removed.

In the case of the I.F. transformers, the primary is the upper coil (red and black leads), and the secondary is the lower coil (green and blue leads).

Scale Lamp.—This is an Osram M.E.S. type, rated at 6.2 V, 0.3 A.

Condenser C31.—This is the band-pass top coupling condenser, and consists merely of one insulated wire looped over another. Its capacity is obviously very low, and the loop should not be disturbed. It is indicated in the under-chassis view.

Condensers C15, C17.—These are two dry electrolytics, each of 8 μF capacity, in a single unit with a common negative (black) lead, and two positives (red). The red lead joined to one of the **V5** heater pins is the positive of **C15.**

Trimmers C25, C26.—These are adjusted through holes in one side of the chassis.

External Speaker.—Two sockets for this are provided on the internal speaker transformer. A low resistance model (about 2 O) should be employed.

Valve V2.—Note that this has the *control grid* taken to the top cap instead of the anode. The anode is taken to pin 2.

Alternative Valves.—**V1** (Mullard FC4 octode) may be a Standard 15A2 heptode, while **V4** (Mullard Pen4VB) may be a Mazda AC2/Pen.

CIRCUIT ALIGNMENT

I.F. Transformers.—Before leaving the factory the I.F. transformers are lined up on an oscilloscope, and the trimmers adjusted to give a band-pass curve. If they are readjusted by listening, or with an output meter, the slight increase in sensitivity obtained does not mean that the previous alignment was necessarily incorrect, but rather that the band-pass effect has been destroyed by altering the trimmers. Unless it is absolutely necessary, the sealed trimmers should therefore not be disturbed. At any rate, the signal frequency circuits should be tackled first, to see if re-alignment of these brings the set back to its normal sensitivity.

Should it be imperative to align the I.F. transformers, tune the set to 2,000 m., and inject a 125 KC/S signal from an oscillator across the aerial and earth terminals. With a suitable output meter connected, adjust **C27, C28, C29** and **C30** for maximum output, reducing the oscillator input as the circuits come into tune.

Signal Frequency Circuits.—First tune the set to 200 m. and inject a 200 m. signal across aerial and earth terminals. Screw up **C20,** then unscrew it a quarter turn. Screw up **C22,** and unscrew half a turn. **C24** will already be almost fully unscrewed. Unscrew **C26** about three turns, and **C25** about two turns. Now adjust **C20, C22** and **C24** for maximum response.

Tune set to 2,000 m., inject a 2,000 m. signal, and adjust **C25** only, for maximum response. Now tune set to 300 m., inject a 300 m. signal, and re-adjust **C20, C22** and **C24** for maximum response. The ganging will now hold over both wavebands. It may be necessary to re-adjust **C24** slightly at 200 m. Do not re-adjust **C20** or **C22** on the L.W. band. Any attempt at re-adjustment on wavelengths other than those specified may result in poor sensitivity in some parts of the wavebands.

MAINTENANCE HINTS & PROBLEMS

Dial Light Fault

There is a tendency to pass over the innocent-looking dial light in the search for a fault. Assuming that the lamp lights, and the connections are sound, it is usually dismissed from further consideration. Quite frequently, however, the flex connections straggle over the wiring and form elusive back couplings, whilst a short to the frame can produce faults that are anything but obvious.

Recently the writer had a case of intermittent excessive hum accompanied by crackle and poor quality. A check of current showed this to be excessive. Further elimination tied this down to the output stage. A little more testing indicated a shorted bias resistance. On removing the chassis from the cabinet the fault had disappeared; replacing the chassis caused the fault to reappear.

When you have the clue, of course, the solution is simple. The dial light mounting was being strained slightly so that it shorted to the chassis and being in parallel with the output valve heater, this shorted out the bias resistance.—K. S.

Use of Plasticine

A piece of plasticine is most useful on a service bench. It is ideal for holding small components or wiring in position temporarily during a test. When filings or other particles of metal get into the gap of a moving-coil speaker, plasticine is just about the only satisfactory material for cleaning out the gap.—K. S.

Instability of H.F. Stage

The following fault recently occurred in a mains superhet portable with a preselector stage. The receiver functioned satisfactorily on the medium waveband, but on long waves the volume was slightly reduced and in addition, reception was spoilt by regular "pumping" sound, indicating instability.

The fault was found to be due to the resistance forming the earth end of the H.F. valve S.G. potentiometer being open circuited. This was shown by the voltage on the screen being about three times that indicated in the TRADER Service Sheet dealing with the set in question.—W. S.

Electrolytic Condenser Troubles

With reference to our notes on this subject on page IV of RADIO MAINTENANCE No. 3, it is pointed out that the third fault, loss of capacity, is often indicated by the H.T. line voltage, if the faulty condenser is the first one following the rectifier, or is part of a voltage doubler circuit associated with a Westinghouse metal rectifier.

Assuming that the rectifier valve or unit is in good order, the full rated H.T. voltage will only be obtained if the condenser is up to its full capacity. This is important, particularly in small H.T. units using metal rectifiers. Loss of capacity in a condenser may cause the voltage to fall so low that even the hum heard is negligible.—W. S.

Failure of Oscillation

Some causes of "dead spots" in superhet receivers were dealt with last week, and here is another which occurred recently. The receiver was a 6-valve mains superhet, and no signals could be received on the L.W. band, while on the M.W. band there was a cut-off above 280 m., the receiver working perfectly below this wavelength.

As far as the medium waves were concerned the fault was intermittent, since very occasionally signals could be heard up to 440 m.

Coils and switchgear were tested and found to be O.K., but on testing each of the de-coupling condensers in turn by shunting with an extra condenser (it had been ascertained that a shorted condenser was not the fault) the condenser in the anode decoupling circuit of the oscillator section of the frequency changer was found to be faulty. Loss of capacity or open circuit was presumably the fault, and a new condenser cured the trouble.—H. H.

Hidden Components

When tracing out and identifying the components in a receiver, do not forget that many manufacturers have a habit of enclosing certain small components, such as fixed resistors, in lengths of large diameter empire tubing. In most cases this is done for insulation purposes.

It is generally possible, by pinching the tubing between the fingers, to feel whether a resistor is hidden inside it.