NUMBER 113 **'TRADER' SERVICE SHEETS**

LISSEN 8109

4-VALVE BATTERY SUPERHET

LISSEN'S 8109 receiver has a 4-valve battery operated superhet chassis with an octode frequency changer and a pentode output valve. Provision is made for an extension speaker and a gramophone pick-up.

CIRCUIT DESCRIPTION

Two alternative aerial connections to coupling coil **L1.** **A1,** for normal use, is directly connected, while **A2,** for use in "swamp" areas, is connected via series condenser **C1.** Band-pass input filter is inductively coupled. Primary **L2, L3** tuned by **C16**; secondary **L4, L5** tuned by **C18.**

First valve (**V1, Ever Ready metallised K80A**) is an octode operating as frequency changer. Oscillator grid coils **L6, L7** tuned by **C20** with shaped vanes for tracking; anode reaction coil **L8.**

Second valve, a variable-mu H.F. pentode (**V2, Ever Ready K50M**) operates as intermediate frequency amplifier with tuned-primary tuned-secondary transformer couplings **L9, L10** and **L11, L12.**

Intermediate frequency 127 KC/S.

Diode second detector forms part of double diode triode valve (**V3, Ever Ready K23B**). Audio-frequency component in rectified output is developed across manual volume control **R7** and passed via **C10** to C.G. of triode section which operates as L.F. amplifier. Tone control by variable condenser **C27.** Provision for connection of gramophone pick-up across **R7.**

Second diode of **V3,** fed from **V2** anode via **C11,** provides D.C. potential which is developed across **R13** and fed back through decoupling circuit as G.B. to F.C. and I.F. valves, giving automatic volume control.

Sensitivity control by pre-set variable potentiometer **R9** which varies A.V.C. delay voltage and negative bias applied to **V3** signal diode, thus giving a degree of inter-station noise suppression.

Resistance-capacity coupling between **V3** triode and output pentode (**V4, Ever Ready K70B**). Tone correction by impedance-limiting filter **R15, C15.**

COMPONENTS AND VALUES

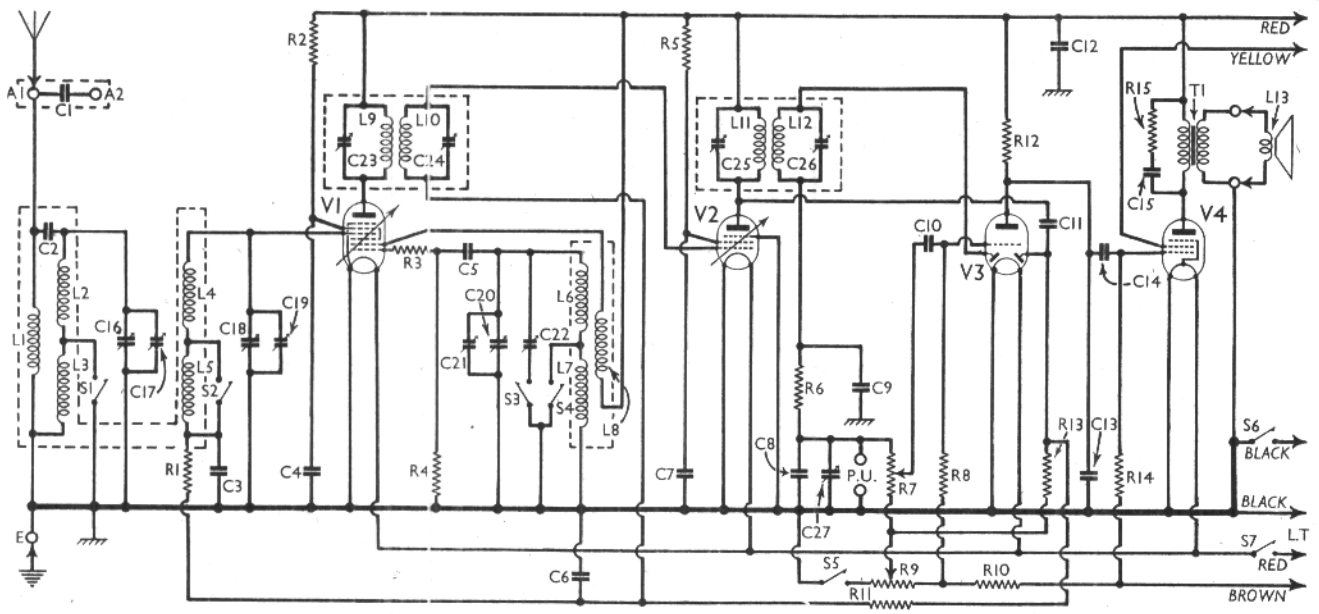
	Resistances	Values (ohms)
R1	V1 pentode C.G. decoupling	66,000
R2	V1 S.G.'s H.T. feed	110,000
R3	V1 osc. C.G. circuit stabiliser	1,100
R4	V1 osc. C.G. resistance	110,000
R5	V2 S.G. H.T. feed	110,000
R6	I.F. stopper	110,000
R7	V3 signal diode load; vol. control	500,000
R8	V3 triode C.G. resistance	1,100,000
R9	Sensitivity control	280
R10	Part of G.B. pot. divider	250*
R11	A.V.C. line decoupling	1,100,000
R12	V3 anode load	51,000
R13	V3 A.V.C. diode load	1,100,000
R14	V4 C.G. resistance	510,000
R15	Part V4 impedance-limiting filter	16,000

* May be 300 Ω.

	Condensers	Values (μF)
C1	Aerial series condenser	0·000015
C2	Capacitative aerial coupling	0·000005
C3	V1 pentode C.G. decoupling	0·1
C4	V1 S.G.'s by-pass	0·1
C5	V1 oscillator C.G. condenser	0·0001
C6	A.V.C. line decoupling	0·1
C7	V2 S.G. by-pass	0·1
C8, C9	I.F. by-passes	0·0001
C10	L.F. coupling to V3 C.G.	0·01
C11	Coupling to V3 A.V.C. diode	0·0001
C12	H.T. supply by-pass	0·01
C13	V3 triode anode I.F. by-pass	0·0005
C14	V3 to V4 L.F. coupling	0·01
C15	Part V4 impedance-limiting filter	0·0025
C16†	Band-pass primary tuning	—
C17‡	Band-pass primary trimmer	—
C18†	Band-pass secondary tuning	—
C19‡	Band-pass secondary trimmer	—
C20†	Oscillator tuning	—
C21‡	Oscillator main trimmer	—
C22‡	Oscillator L.W. trimmer	—
C23‡	1st I.F. trans. pri. tuning	—
C24‡	1st I.F. trans. sec. tuning	—
C25‡	2nd I.F. trans. pri. tuning	—
C26‡	2nd I.F. trans. sec. tuning	—
C27†	Variable tone control	—

† Variable. ‡ Pre-set.

	Other Components	Approx. Values (ohms)
L1	Aerial coupling coil	24·0
L2	Band-pass primary coils	2·3
L3		15·0
L4	Band-pass secondary coils	2·3
L5		15·0
L6	Oscillator grid tuning coils	2·9
L7		3·3
L8	Oscillator anode reaction coil	45·0
L9	1st I.F. trans. Pri.	93·0
L10	1st I.F. trans. Sec.	93·0
L11	2nd I.F. trans. Pri.	42·0
L12	2nd I.F. trans. Sec.	42·0
L13	Speaker speech coil	1·2
T1	Output trans. Pri.	850·0
	Output trans. Sec.	0·3
S1-S4	Waveband switches	—
S5	G.B. switch	—
S6	H.T. circuit switch	—
S7	L.T. switch	—



Circuit diagram of the Lissen 8109 battery superhet. In later models there may be an extra 100 Ω resistance between R9 and S5 in which case S5 will be returned to L.T.+.

DISMANTLING THE SET

A detachable bottom is fitted to the cabinet and upon removal (four round-head wood screws with washers) gives access to most of the under-chassis components.

Removing Chassis.—Remove back (two coin-slot screws), batteries and the four control knobs (pull off). Free speaker and battery leads from cleat on side of cabinet and remove the four chassis fixing bolts (with washers). Chassis can now be withdrawn to extent of speaker leads, which is adequate for normal purposes.

When replacing, note that control knobs are marked and must be placed on the correct spindles.

To free chassis entirely, unplug speaker leads from sockets at back of chassis.

Removing Speaker.—Remove nuts, spring washers and washers from the four bolts holding sub-baffle, and remove nuts, spring washers and washers from the four bolts holding speaker to sub-baffle. *When replacing*, see that transformer is at bottom.

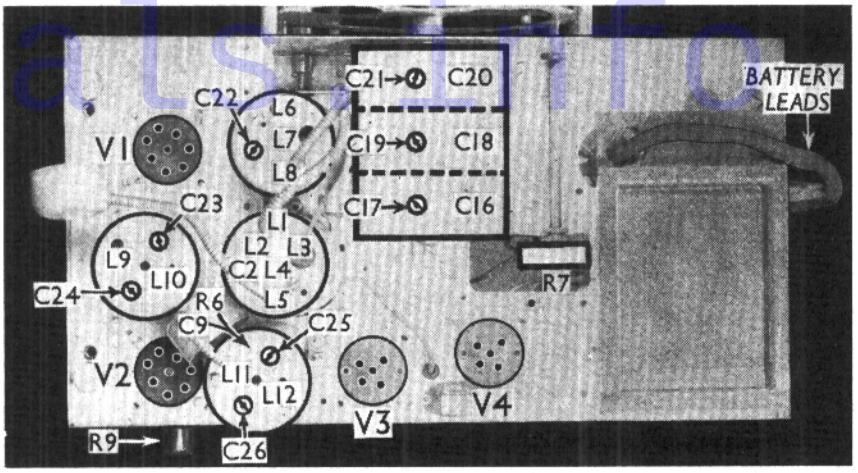
VALVE ANALYSIS

Valve voltages and currents given in the table below are those measured in our receiver when it was operating from a new battery reading 140 V on the H.T. section. Both the volume and sensitivity controls were at maximum and the receiver was tuned to the lowest wavelength on the medium band, but there was no signal input.

Voltages were measured on the 1,200 V scale of an Avometer, with chassis as negative.

Valve	Anode Volts	Anode Current (mA)	Screen Volts	Screen Current (mA)
V1 K80A*	140	0·6	53	0·7
V2 K50M	140	1·0	84	0·3
V3 K23B	104	0·4	—	—
V4 K70B	133	5·6	140	1·4

*Osc. anode (G2) 140 V, 0·7 mA.



Plan view of the chassis. The L1-L5 unit also contains C2, while the L11, L12 unit includes R6 and C9.

GENERAL NOTES

Switches.—**S1-S4** are the waveband switches, and **S5-S7** the battery switches. All are ganged together in a single unit beneath the chassis. The table below gives the switch positions for the various control settings, O indicating open, and C, closed.

Switch	Off	M.W.	L.W.
S1	C	C	O
S2	C	C	O
S3	O	O	C
S4	C	C	O
S5	O	C	C
S6	O	C	C
S7	O	C	C

It should be noted that the set of contacts between **S1** and **S2** is not used, being shorted out and connected to chassis.

Coils.—All the coils are in four screened units on the chassis deck. The **L1-L5** unit contains **C2,** the **L6-L8** unit contains the oscillator L.W. trimmer **C22,** while the second I.F. unit, **L11, L12,** contains **R6** and **C9** in addition to its trimmers.

External Speaker.—This should be of the low resistance type (1.5-2.5 O), and may be connected to the sockets at the rear of the chassis, or to the socketed plugs of the internal speaker leads.

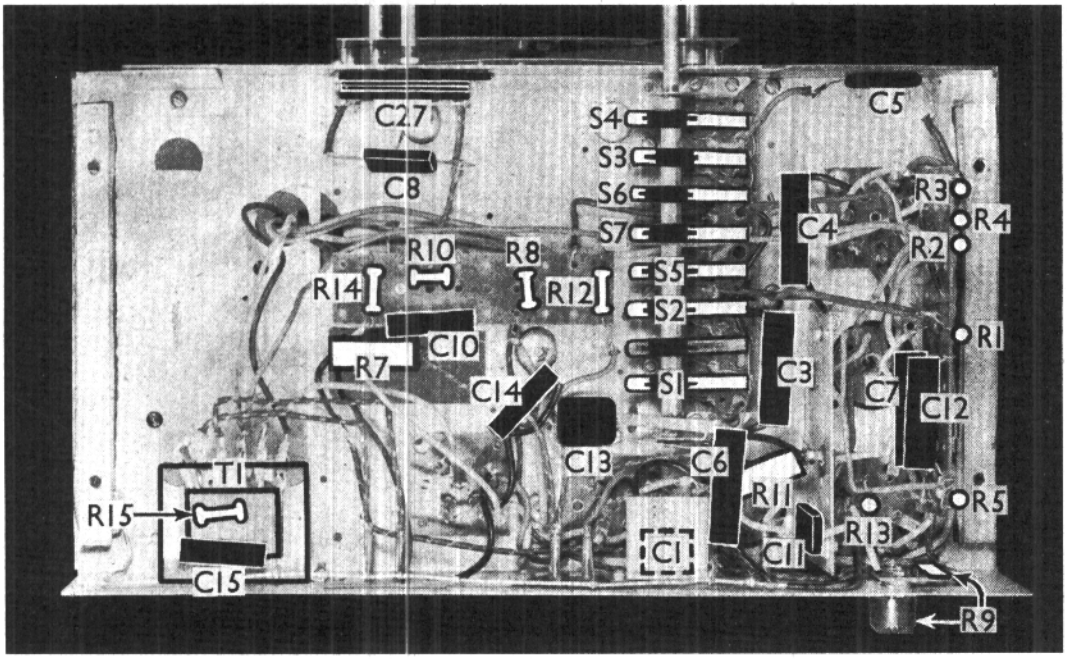
Batteries.—L.T., Lissen 2 V 30 AH celluloid cased cell, type LN88006. H.T. and G.B., Lissen 132 V + 4.5 V battery, type LN3028.

Battery Leads and Voltages.—Black, spade tag, L.T. negative; Red, spade tag, L.T. positive 2 V; Black lead and plug, H.T. negative; Brown lead and plug, G.B. negative 4.5 V; Red lead and plug, H.T. positive 132 V; Yellow lead and plug, H.T. positive, according to letter marked on **V4** output valve. A, 132 V; B, 124.5 V; C, 117 V; D, 109.5 V.

To find correct position of yellow plug for an unmarked K70B valve, remove all valves but this one, and connect a milliammeter in series with the *red* lead. Switch on the set, and adjust the yellow plug until the milliammeter reads 4.5 mA. Use a new battery for this adjustment.

Chassis Divergencies.—In late models there may be a 100 O resistance in series between **R9** and **S5.** In this case the other side of **S5** will be returned to L.T. positive, instead of chassis. Resistance **R10** may be 300 O instead of 250 O.

Circuit Alignment.—This will be found on page IV (overleaf).



Under-chassis view. C1 is inside a screening box. The switch unit between S1 and S2 is not used.

MAINTENANCE HINTS & PROBLEMS

Routine Tests : Helpful Gadgets : Unusual Faults

Crackle and Instability

An Ekco A.C.74 receiver was returned for repair, the trouble being crackle on the M.W. band whenever the tuning control was touched. The wave-change switch was at first suspected, but the set was no better after it had been cleaned. The tuning condenser was examined and found to be O.K. Finally the scale lamp system was suspected and it was found that the bearing of the pulley supplying current to the cable connected to the M.W. scale bulb was dirty, thus causing crackle when the set was switched to M.W. This bearing was adjusted and cleaned and the receiver then operated perfectly.

* * *

A Philips 472A receiver was my next problem. The complaint was instability in certain parts of the dial. All decoupling condensers, etc., were tested and found O.K.; in fact, the set seemed in every way up to standard. All coil screens were tested for good earth and found to be normal. Finally, the variable condenser spindle was short-circuited to the chassis, and immediately the instability disappeared, and the set became perfectly normal. A permanent contact was then fitted to the short length of spindle protruding from the back of the condenser cover, and the set has worked perfectly ever since. Apparently minute voltages had been building up across the condenser spindle causing feed back and instability.—P. W.

Another Condenser Fault

An all-mains superhet was being examined for an intermittent complete stoppage. Eventually the set became quite dead altogether. It was ascertained that the L.F. side was O.K. and that the I.F. amplifier was working. By using the service oscillator in its stead, it was found that the internal oscillator was out of action. The frequency-changer was a triode-pentode, cathode injection being used.

Voltages and currents were checked and found normal. A systematic check of all components in the oscillator circuit was made without revealing any fault, although the padding condensers were even measured for capacity on the bridge. To do this, it was found necessary to remove a paxolin strip carrying these condensers. This was replaced, and the set was connected up once more with a view to ascertaining if any further clue could be gathered. It was then found that the set worked perfectly, but only for a minute or so, and then became dead again. This time, however, it was discovered that a knock on the side of the chassis brought intermittent results. This was narrowed down to the paxolin strip mentioned, as it was possible, by pushing this in one direction to bring on the fault. A dry joint being suspected, a very careful survey of all connections to the assembly was made, but nothing to cause the trouble was found.

Only by exercising great patience was it discovered that if the strip itself was held steady, and one particular wire moved with a pair of pliers, the fault could be brought on. This wire was a straight piece of tinned copper, forming a direct connection between two "tag-end" flat type condensers. Both condensers were removed, and tested by a neon lamp passing an alternating current. One condenser worked until its connecting tag was pushed a little to one side. As this was the "tying-down" condenser for the oscillator anode, it was easy to see why this caused the lack of signals. The disconnection was, of course, inside the moulded case of the condenser and could not be seen.—F. B.

Intermittent Operation

An A.C./D.C. receiver employing five valves, frequency changer, variable-mu H.F. pentode, double diode, output pentode, rectifier, and barretter for voltage regulation of the heater circuit was received for service with the complaint that it would function perfectly—the term usually employed to express normal operation!—for a few minutes, and sometimes about half an hour, and would then suddenly cease to operate.

Aerial and earth were connected, receiver switched on and found to be, apparently, working all right on both wave bands, but after a few minutes the loud-speaker became silent. The series scale lamp bulb indicated that the heater circuit was intact. The eight side-contact output pentode was removed and plugged into the emission tester and the anode current and voltage were normal.

As this set, in common with other A.C./D.C. sets, was not arranted for "pick-up" connection, a lead from the audio-frequency oscillator was clipped to the control grid of the pentode to form an idea as to whether there might be an intermittent short-circuit in the output stage, such as short-circuited or open-circuited speech coil. However, the signal from the speaker was quite loud, and the output stage was passed as being in order. The oscillator lead was next clipped to the top cap (detector diode) of the double diode valve, but the oscillator signal was now very weak, which seemed to indicate a fault between the double diode and the output valve. Before removing chassis, however, the hand was placed over each valve in turn to ascertain whether all were warm, and all were, excepting the H.F. pentode. It was found that the screen grid volts on this valve were nil.

The chassis was removed, and the trouble traced to an intermittent open-circuit in the 10,000 O resistance feeding the screen, although no fracture of the resistance was visible. The resistance element proper, like the lead through a lead pencil, was either broken or making intermittent contact with the metal ends. A peculiarity of the L.F. oscillator test was that when the oscillator lead was clipped to the detector diode only faint signals were heard until the *H.F. pentode* received its screen volts.—M. F.

WE INVITE readers to submit paragraphs based on their own experiences. The kinds of hints required will be gathered from a perusal of this page.

Do not worry if you are not able to put your ideas into a suitable form. Send us the ideas—we will do the rest. The same applies to any sketches or circuits, which need only be roughly drawn.

Payment will be made for all ideas and articles used about the 10th of the month following publication. They should be addressed to the Technical Editor, THE WIRELESS TRADER, *Dorset House, Stamford Street, S.E.1.*

LISSEN 8109 CIRCUIT ALIGNMENT

See pages II and III for circuit and chassis illustrations

I.F. Circuits.—Apply a 127 KC/S signal between **V1** control grid (top cap) and chassis, *via* a .002 μF condenser. Remove the existing screened lead from the top cap, and connect a 0.5 MO resistance between top cap and chassis. Connect an output meter across the primary of **T1.**

When adjusting an I.F. primary, connect a 50,000 O resistance across the secondary, and *vice versa*. Adjust **C26, C25, C24** and **C23** for maximum output, in that order.

Input and Oscillator Circuits.—Rotate the gang till the pointer is at the high wavelength end of scale. Ascertain that the rotor vanes are in full mesh with the pointer at the two index marks (dots) at the top and bottom of the scale. If necessary, adjust pointer by slackening centre fixing screw.

Apply a signal of 196 m. to the aerial terminal, switch set to M.W. and rotate gang until pointer is at the lower wavelength end of scale. Adjust **C21, C19, C17** in turn for maximum output.

Switch receiver to L.W., rotate gang until pointer reads 1,300 m. Apply a 1,300 m. signal, and adjust **C22** for maximum output.