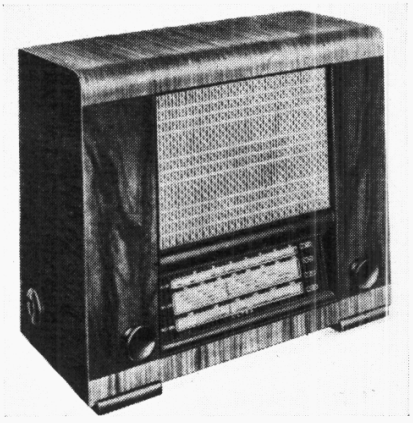
"TRADER" SERVICE SHEET
1017

ULTRA "LEADER" Series

Covering Leader 51, Ultragram 51 and their predecessors



The appearance of the Leader 51.

INTERESTING features of the Ultra Leader 51 circuit are the inclusion of a neutralizing device in the I.F. amplifier to permit increased gain and the attainment of a symmetrical flat-topped I.F. response curve without an elaborate alignment procedure, a second neutralizing circuit to off-set coupling between adjacent contacts of the waveband switch, and a prefabricated variable tuning unit.

The receiver is a 4-valve (plus rectifier) 3-band superhet designed to operate from A.C. mains of 200-250 V, 50 c/s. The waveband ranges are 16-51 m, 185-550 m and 1,000-2,000 m.

The Ultragram 51 is a 3-speed autoradiogram employing a slightly modified Leader 51 chassis, the differences being fully explained under "Associated Models," overleaf. Explained there also are the differences between these models and their predecessors, the Leader and Ultragram.

Release dates and original prices: Leader 51, *May* 1951, £19 12s 3d; *Ultragram* 51, *May* 1951, £63 0s 9d; *Leader*, 1950, £17 6s; *Ultragram*, *August* 1950, £58 16s 8d.

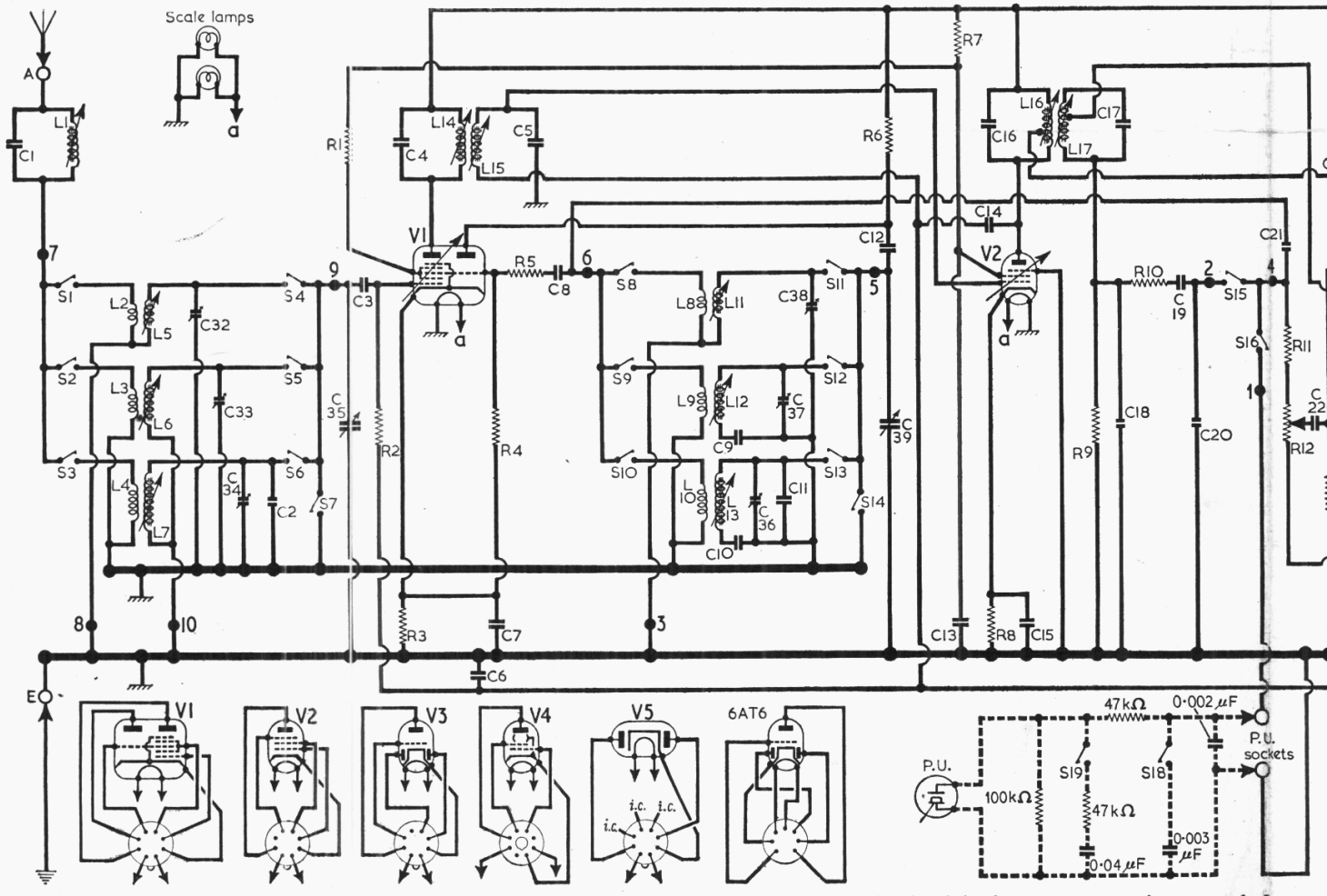
CIRCUIT DESCRIPTION

Aerial input via I.F. filter **C1, L1** and coupling coils **L2** (S.W.), **L3** (M.W.) and **L4** (L.W.) to single-tuned circuits **L5, C35** (S.W.), **L6, C35** (M.W.) and **L7, C35** (L.W.), which precede triode heptode valve **(V1, Mazda 6C9)** operating as frequency changer with internal coupling.

Triode oscillator anode coils **L11** (S.W.), **L12** (M.W.) and **L13** (L.W.) are tuned by **C39.** Parallel trimming by **C38** (S.W.), **C37** (M.W.) and **C11, C36** (L.W.); series tracking by **C9** (M.W.) and **C10** (L.W.). Inductive reaction coupling from grid by **L8** (S.W.), **L9** (M.W.) and **L10** (L.W.).

Second valve **(V2, Mazda 6F15)** is a variable-mu R.F. pentode operating as intermediate frequency amplifier with tuned transformer couplings **C4, L14, L15, C5** and **C16, L16, L17, C17.**

Intermediate frequency 471 kc/s.



Circuit diagram of the Ultra Leader 51 with, inset beneath the chassis line in dotted lines, the circuit of the frequency-correcting network for norm

L15 is effectively tuned by **C5** and **C6**, which are connected across it with their common point connected to chassis. Voltages appearing across **C6** will therefore be in anti-phase to those across **C5**, and by feeding back some of **V2** output, via **C14**, to the bottom end of **L15** the resulting voltage appearing at the top end will be in anti-phase. This anti-phase voltage applied to **V2** grid neutralizes the positive feed-back caused by the valve's internal anode-to-grid capacitance.

Diode signal detector is part of double diode triode valve **(V3, Mazda 6LD20).** Audio frequency component in rectified output is developed across diode load resistor **R9** and passed via **C19,** volume control **R12** and **C22** to grid of triode section, which operates as A.F. amplifier. I.F. filtering by **C18, R10, C20** and **C27.**

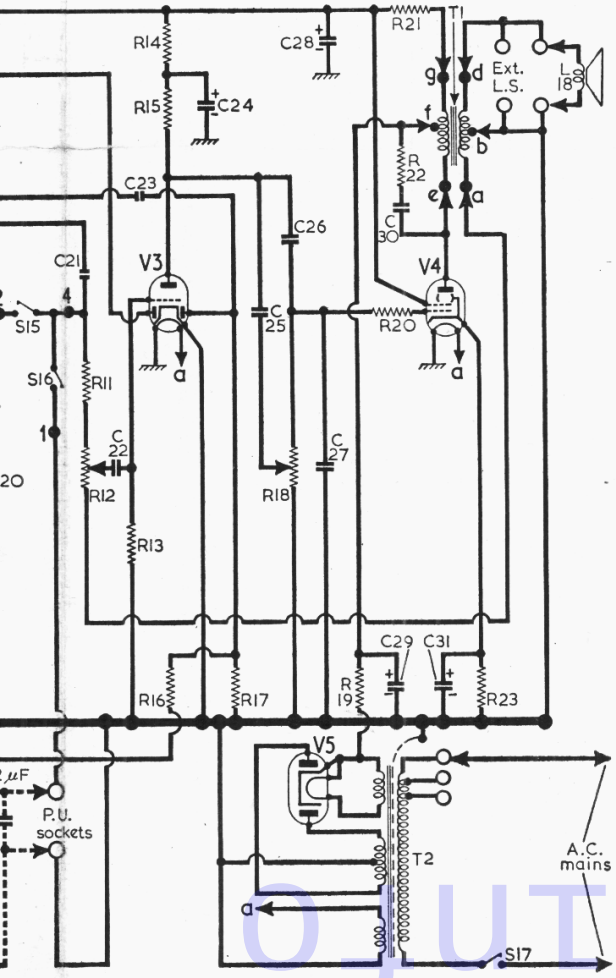
Second diode of **V3** is fed via **C23** from a tap on **L16,** and the resulting D.C. potential developed across diode load **R17** is fed back as bias to F.C. and I.F. valves giving automatic gain control.

Provision is made for the connection of a gramophone pick-up across the volume control via **S16** which closes in the gram position of the waveband switch control. At the same time **S15** opens, and **S7, S14** close in this position to mute radio. Owing to some small capacitance between the gram switches and the oscillator anode switches **S11-S14,** resulting from their mutual proximity on the switch unit, a small amount of oscillator-frequency voltage tends to build up across the volume control.

When present, this voltage appears as an audible hiss at the maximum setting of the volume control, and it is neutralized in this receiver by feeding a small amount of oscillator signal in anti-phase via **C21** to the volume control circuit.

Resistance-capacitance coupling by **R15, C26** and **R18,** via grid stopper **R20,** between **V3** triode and control grid of beam tetrode output valve **(V4, Mazda 6P25).** Variable tone control by **C25** and **R18.** Fixed tone correction by **R22** and **C30,** and by the negative feed-back between section **b-a** of the output transformer **T1** secondary and the volume control circuit. Provision is also made for the connection of a low impedance external speaker across section **d-b** of **T1** secondary.

H.T. current is supplied by I.H.C. full-wave rectifying valve **(V5, Mazda UU9).** Smoothing by **R21** and electrolytic capacitors **C28, C29,** residual hum being neutralized by feeding the H.T. current through part of **T1** primary, section **g-f. R19** protects **V5** from surge currents.



work for normal and L.P. records as used in the Ultragram 51.

COMPONENTS AND VALUES

	CAPACITORS	Values	Locations
C1	I.F. filter tune ...	270pF	A1
C2	L.W. fixed trim. ...	65pF	G4
C3	V1 C.G.	500pF	A1
C4	1st I.F. trans. tuning	120pF	B1
C5		120pF	B1
C6	A.G.C. decoupling	0·04μF	F3
C7	V1 cath. by-pass ...	0·04μF	F3
C8	V1 osc. C.G. ...	100pF	G3
C9	M.W. osc. tracker	470pF	F4
C10	L.W. osc. tracker	165pF	G4
C11	L.W. fixed trimmer	125pF	F4
C12	Osc. anode coup....	100pF	F3
C13	V1, V2 S.G. decoup.	0·05μF	F3
C14	Neutralizer ...	0·85pF	F4
C15	V2 cath. by-pass.	0·04μF	F4
C16	2nd I.F. trans. tuning	114pF	B2
C17		124pF	B2
C18	I.F. by-pass ...	50pF	F4
C19	A.F. coupling ...	0·01μF	F4
C20	I.F. by-pass ...	33pF	F4
C21	Neutralizer ...	2·5pF	F3
C22	A.F. coupling ...	0·01μF	E4
C23	A.G.C. coupling ...	50pF	E4
C24*	V3 anode decoup.	1μF	E4
C25	Part tone control...	0·01μF	D4
C26	A.F. coupling ...	0·04μF	E4
C27	I.F. by-pass ...	100pF	D4
C28*	H.T. smoothing ...	50μF	B2
C29*		50μF	B2
C30	Part tone correction	0·01μF	D4
C31*	V4 cath. by-pass ...	100μF	D3
C32‡	S.W. aerial trim. ...	—	G3
C33‡	M.W. aerial trim....	—	G3
C34‡	L.W. aerial trim. ...	—	G4
C35†	Aerial tuning ...	483pF	A2
C36‡	L.W. osc. trimmer	—	G4
C37‡	M.W. osc. trimmer	—	F4
C38‡	S.W. osc. trimmer	—	F3
C39†	Osc. tuning ...	483pF	A2

* Electrolytic. † Variable. ‡Pre-set.

	OTHER COMPONENTS	Approx. Values (ohms)	Locations
L1	I.F. filter ...	—	A1
L2	Aerial coupling coils	—	G4
L3		33·0	G4
L4		130·0	G4
L5	Aerial tuning coils	—	G4
L6		3·0	G4
L7		17·0	G4
L8	Oscillator reaction coils	0·4	F4
L9		0·5	F4
L10		0·8	G4
L11	Oscillator tuning coils	—	F4
L12		2·5	F4
L13		5·0	G4
L14	1st I.F. trans. Pri.	7·5	B1
L15	1st I.F. trans. Sec.	7·5	B1
L16	2nd I.F. trans. Pri.	7·5	B2
L17	2nd I.F. trans. Sec.	7·5	B2
L18	Speech coil ...	3·0	—
T1	O.P. trans. g-f ...	11·0	E3
	O.P. trans. f-e ...	370·0	
	O.P. trans. d-b ...	0·25	
	O.P. trans. b-a ...	1·0	
T2	Mains trans. Pri., total	35·0	C2
	Mains trans. H.T. sec., total	235·0	
	Mains trans. Rect. htr.	—	
	Mains trans. Htr. sec.	—	
S1-S16	Waveband switches	—	G4
S17	Mains sw., g'd R12	—	D3

	RESISTORS	Values	Locations
R1	V1 S.G. stopper ...	100Ω	F3
R2	V1 C.G.	470kΩ	F3
R3	V1 G.B.	220Ω	F3
R4	V1 osc. C.G. ...	47kΩ	F3
R5	Osc. stabilizer ...	220Ω	F3
R6	Osc. anode feed ...	68kΩ	F3
R7	V1, V2 S.G. feed ...	18kΩ	F4
R8	V2 G.B.	300Ω	F3
R9	Diode load ...	470kΩ	F4
R10	I.F. stoppers ...	470kΩ	F4
R11		22kΩ	B1
R12	Volume control ...	500kΩ	D3
R13	V3 C.G.	10MΩ	E4
R14	V3 anode decoup.	100kΩ	E4
R15	V3 anode load ...	220kΩ	E4
R16	A.G.C. decoupling	1MΩ	E3
R17	A.G.C. diode load	470kΩ	E4
R18	Tone control ...	500kΩ	D4
R19	Surge limiter ...	100Ω	E3
R20	V4 C.G. stopper ...	5·6kΩ	E4
R21	H.T. smoothing ...	1·2kΩ	E4
R22	Part tone correction	3·3kΩ	E4
R23	V4 G.B.	180Ω	D4

VALVE ANALYSIS

Valve voltages and currents given in the table below are those measured in our receiver when it was operating from A.C. mains of 230 V. The set was tuned to the high wavelength end of M.W. with the vollme control at maximum, but there was no signal input.

Voltage readings were measured on the 10 and 400 V ranges of a Model 7 Avometer, chassis being the negative connection.

Valves	Anode V	Anode mA	Screen V	Screen mA	Cath. V
V1 6C9	220	2·5	76	6·2	2·2
	Oscillator				
	54	2·2			
V2 6F15	220	4·5	76	1·4	1·7
V3 6LD20	32	0·7	—	—	—
V4 6P25	236	36·0	220	0·7	7·0
V5 UU9	240†	—	—	—	255·0

† A.C. voltage.

GENERAL NOTES

Tuning Assembly.—All the aerial and oscillator circuit components, with the exception of the tuning gang, are housed in a special tuning assembly beneath the chassis. This is indicated on the right in our under-chassis illustration, where all the components it contains are identified, although four capacitors **C9, C10, C11** and **C2** are shown in broken line as they are not visible.

To obtain access to the inside of the assembly, the whole unit must be removed and the upper side (facing the chassis deck) taken off. Instructions for doing this can be derived from the connections,

(*Continued col. 1 overleaf.*)

numbered **1** to **10,** which are shown in the chassis drawing and in our circuit diagram overleaf.

In view of the rather specialized nature of this assembly, the makers advise dealers not to attempt to carry out repairs to them. All repairs should be carried out on special jigs, and arrangements have been made for all faulty units returned to Ultra to be serviced by the makers.

Switches.—**S1-S14** are the waveband and radio muting switches, and **S15, S16** are the radio/gram change-over switches, ganged together as part of the tuning assembly. The outer tags, which are indicated in our under-chassis view, are on one side of the tuning assembly, and the common contacts are on the opposite side. The central spindle drives the five sprung wipers which sweep the contacts.

The positions of the five sets of switches are indicated in our illustration by the numbers **1** to **5** in diamonds, and the five sets of switches, similarly numbered, are shown in detail in the diagrams in col. 2.

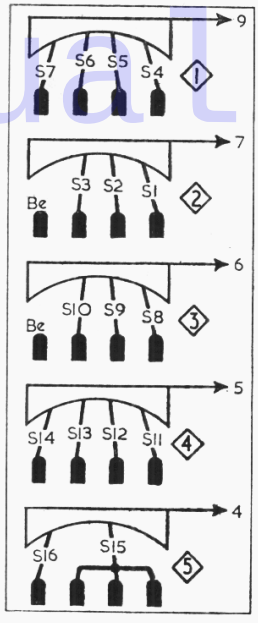
Here they are drawn as seen from one end of the unit, as indicated by the arrows, after it has been removed from the chassis and turned over, with the upper cover off, revealing the inside of the assembly as seen "through" the chassis deck.

The table (col. 2) gives the switch positions for the four control settings, starting from the fully anti-clockwise position of the control knob. A dash indicates open and **C** closed.

Scale Lamps.—These are two Osram M.E.S. types, with small clear spherical bulbs, rated at 6.5 V, 0.3 A. They are held in rubber grommets, whose grooves fit snugly into slots stamped into the tuning scale plate.

External Speaker.—Two vertical pairs of sockets are provided on adjacent panels at the rear of the chassis for the connection of speakers. One pair is intended for the internal speaker, and the other for a low impedance (about 3 Ω) external speaker. It is immaterial which pair is used for which speaker.

Valve V3.—In some Leader 51 chassis this will be a Mazda 6LD20, as it was in our sample, but in others it will be a Mullard EBC41, whose base connections are similar. The Mullard valve has been used in all Ultragram 51 models so far, but at the time of writing, a change is being made over to the Brimar 6AT6, whose base connections are inset to the right of the other five beneath our circuit diagram overleaf. In the earlier Leader and Ultragram **V3** was always a 6LD20.



Diagrams of the five sections of the waveband switch assembly in the R.F. tuning assembly. The numbered arrowheads represent connecting tags which project from the side of the unit. These diagrams are drawn as seen when viewed from the opposite end to the control knob, after the unit has been removed and turned over. Below is the switch table.

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

Associated Models

Ultragram 51.—A slightly modified Leader 51 chassis is used in the Ultragram 51, which employs a Garrard RC72 or RC72A 3-speed auto-changer whose motor leads are connected directly to the A.C. mains.

As compared with the table radio receiver, **C19** becomes 0.001 μF, **V3** is a Mullard EBC41 or Brimar 6AT6, and a frequency-correcting circuit is added to modify the response to suit normal or long-playing records. The frequency-correcting circuit, involving the 2-position switch unit **S18, S19,** is shown in dotted lines beneath our main circuit diagram, where it will be seen to be included in the leads from the pick-up to the P.U. sockets.

The switch unit is mounted on the motor board. In the normal position **S19** closes, for 78 R.P.M. records; in the L.P. position **S18** closes, while **S19** opens, to give increased "top cut" for 33 R.P.M. and 45 R.P.M. records.

Earlier Leader.—The circuit diagram of the earlier Leader was basically like that of the Leader 51, but there were the following differences as compared with the details given for our chassis. The aerial I.F. rejector **L1, C1** was omitted, the special I.F. neutralizing circuit was omitted, and **C21** was omitted.

In the first I.F. transformer **C5** was connected directly across **L15,** and in the second I.F. transformer neither coil was tapped, and **C23** went to **V2** anode, and was 100 pF. **R9** and **C19** were omitted, **R11** and **R12** acting as the signal diode load.

All 0.04 μF capacitors in our tables were 0.05 μF. **C3** was 390 pF, **C17** was 120 pF, **C18** was 47 pF and **C27** was 200 pF. **C20** was omitted, and a 100 pF capacitor was connected between the top of **R11** and chassis to replace it.

Earlier Ultragram.—The early Ultragram was a 3-speed autoradiogram employing a modified Leader chassis that was a cross between the original Leader and the Ultragram 51. The same Garrard unit was used..

The signal detector circuit was the same as the 51, except that **R10** was 270 kΩ. The same pick-up correcting circuit was included in the P.U. leads, but the values of the three capacitors, reading from left to right in our diagram, were 0.05 μF, 0.002 μF and 0.001 μF.

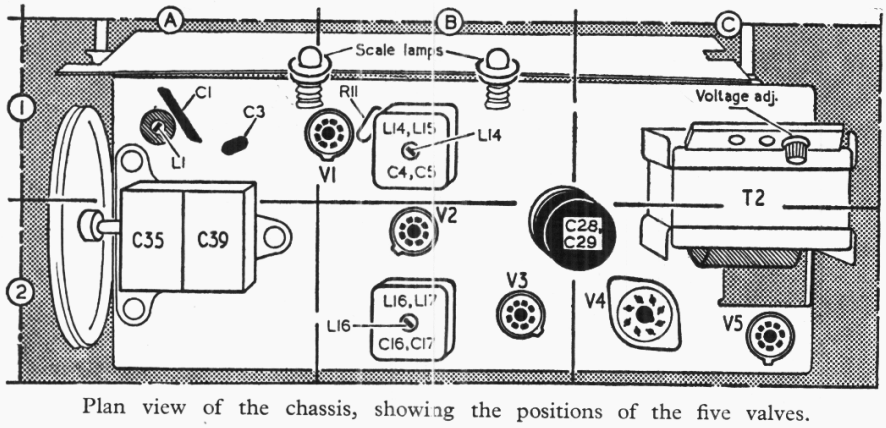
The secondary of the 2nd I.F. transformer **L17** was tapped to feed the signal diode, but the primary was not tapped. The I.F. neutralizing circuit involving **C14** was not present, the I.F. circuits being like those of the Leader, and the oscillator neutralizing coupling **C21** was not present.

CIRCUIT ALIGNMENT

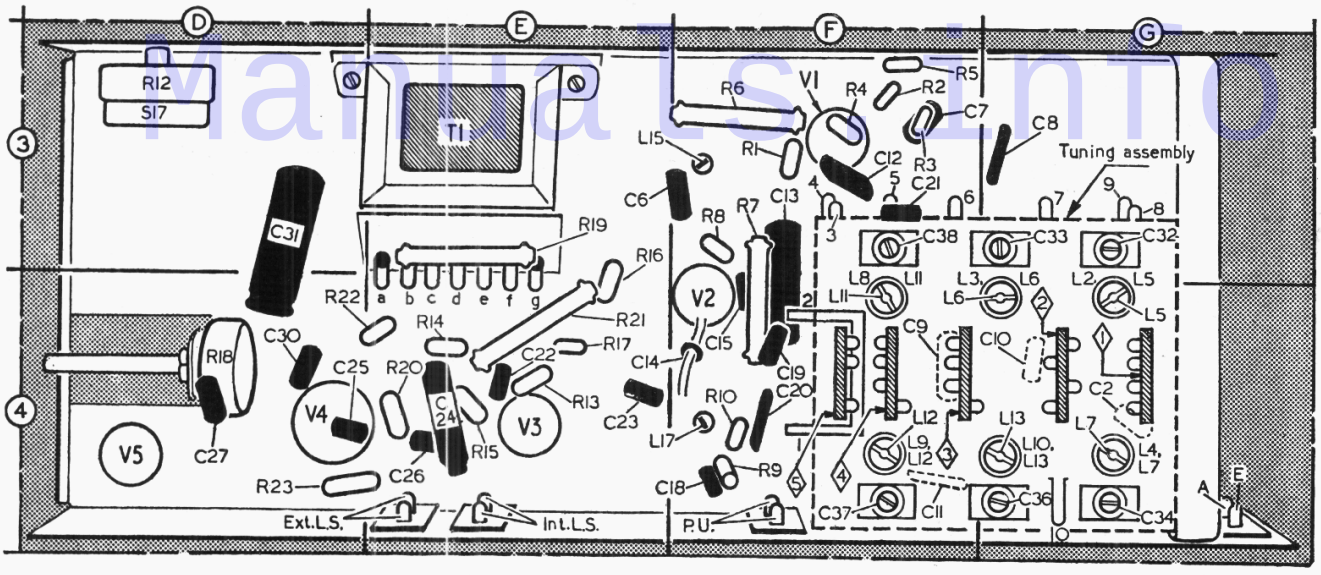
The I.F. amplifier in the Leader 51 has been designed to have a "flat-topped" response with a bandwidth of ±3 kc/s about a centre frequency of 471 k/cs. To achieve this the 1st I.F. transformer has been over-coupled to give a "double-humped" response, while the 2nd I.F. transformer has a single-peak response. The correct flat-topped response is easily obtained if the following alignment procedure is adhered to.

In the earlier Leader, the I.F. alignment is quite straightforward, all four cores being adjusted for maximum output, but the frequency is 470 kc/s.

Switch set to M.W. and turn gang to maximum. Turn volume control and tone control fully clockwise and connect output meter across **T1** primary winding. During alignment adjust output from signal generator so that output meter reading does not exceed 22 V. Use a completely insulated trimming tool and check each adjustment carefully.



Plan view of the chassis, showing the positions of the five valves.



Underside view of the chassis, with the tuning assembly in position. Diagrams of the switch units appear in col. 2.

I.F. Stages.—Connect signal generator output, via an 0.01 μF capacitor in the "live" lead to control grid (pin 6) of **V2** and chassis. Detune **L15** (location reference F3) by unscrewing core flush with end of former. Feed in a 471 kc/s (637 m) signal modulated by 400 c/s to a depth of 30%, and adjust the cores of **L17** (F4) and **L16** (B2) for maximum output. Repeat these last two adjustments carefully. Transfer signal generator "live" lead to junction of **C35** and **C3,** and adjust the core of **L14** (B1) and **L15** (F3) for maximum output.

Tune signal generator about 471 kc/s and check that the response is level between the limits ±3 kc/s or is symmetrical about 471 kc/s, with a slight dip in the centre. If the response is not level or symmetrical the following adjustments must be made.

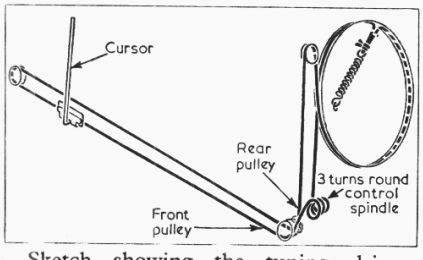
Adjust output of signal generator at 471 kc/s to give an output meter reading of 22 V. Tune signal generator to the excessive peak and reduce the amplitude of the peak by adjusting the core of **L15,** screwing it in if the peak is below 471 kc/s, or out if it is above 471 kc/s. Repeat the above procedure if necessary.

I.F. Filter.—Connect output of signal generator, via a dummy aerial, to **A** and **E** sockets and feed in a 471 kc/s signal. With the set tuned to the high wavelength end of M.W., tune signal generator to centre of I.F. response curve and adjust the core of **L1** (A1) for minimum output, selecting the greater dip if two dips are found.

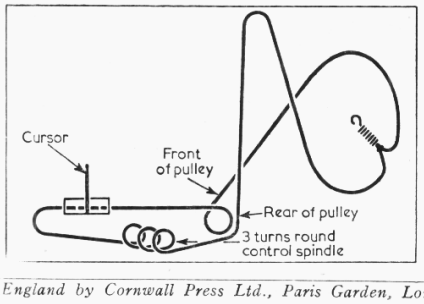
Swing signal generator frequency about this minimum, and check that the rise in output immediately on each side of the minimum is symmetrical. The rise in output on each side of the minimum can be equalized by a fine adjustment to the core of **L1.**

R.F. and Oscillator Stages.—Check that with the gang set to maximum the cursor coincides with the vertical line at the top right hand end of the tuning scale panel. Numbered alignment points are printed along the top of the tuning scale. and this mark is $\frac{7}{16}$in beyond the last one (No. 11). These numbers are quoted in parentheses after the appropriate frequency for each alignment setting in the following instructions. Connect signal generator leads, via a suitable dummy aerial, to **A** and **E** sockets. The procedure is the same for the Leader 51 and the earlier Leader.

L.W.—Switch set to L.W. and tune to 2,000 m (11). Feed in a 2,000 m (150 kc/s) signal and adjust the cores of **L13** (G4) and **L7** (G4) for maximum output. Tune set to 1,000 m (8), feed in a 1,000 m (300 kc/s) signal and adjust **C36** (G4) and **C34** (G4) for maximum output. Repeat these adjustments, then tune to 1,429 m (9), feed in a 1,429 m (210 kc/s) signal, and check calibration. Tune to 1,500 m (10) and check calibration against B.B.C. L.W. Light transmission.



Sketch showing the tuning drive systems of the Leader 51 (above) and the Ultragram 51 (below) as seen from the front.



M.W.—Switch set to M.W., tune to 500 m (7), feed in a 500 m (600 kc/s) signal and adjust the cores of **L12** (F4) and **L6** (G4) for maximum output. Tune set to 200 m (4), feed in a 200 m (1,500 kc/s) signal and adjust **C37** (F4) and **C33** (G3) for maximum output. Repeat these adjustments. Tune set to 300 m (5), feed in a 300 m (1,000 kc/s) signal and check calibration. Tune set to 330.5 m (6) and check calibration on B.B.C. Home Service transmission.

S.W.—Switch set to S.W., tune to 40 m (3), feed in a 40 m (7.5 Mc/s) signal and adjust the cores of **L11** (F4) and **L5** (G4) for maximum output. Tune set to 20 m (1), feed in a 20 m (15 Mc/s) signal and adjust **C38** (F3) and **C32** (G3) for maximum output, rocking gang while adjusting **C32** to obtain optimum results. Tune to 30 m (2), feed in a 30 m (10 Mc/s) signal and check calibration.

DRIVE CORD REPLACEMENT

Leader 51.—Five feet of cord is required for a new drive cord, and that in our sample was nylon braided glass yarn. It should be run as shown in our sketch in the upper drawing in the next column, which is drawn viewing the chassis from the right-hand front corner, with the gang at minimum.

The simplest method of running the cord is to set the gang at maximum, loop the tension spring with a non-slip knot to one end of the cord, and hook it to the anchorage on the gang drum. Then run the cord down to the control spindle, commencing with about a quarter-turn anticlockwise round the drum as viewed in our sketch. The rest of the run can be made while pulling against the gang stop to hold the cord in place.

Ultragram 51.—We did not have a sample of this model on which to work, but we reproduce in col. 5 the tuning drive system drawing as shown in the makers' service manual. They give the length of cord as approximately five feet.

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

*