"His Master's Voice"

SERVICE MANUAL

for

SIX VALVE
DUAL WAVE A.C. RECEIVER
MODEL 409

AND

DUAL WAVE A.C. RADIOGRAM
MODEL 429

around the turntable bush. The tooth engages with the face A, thus pushing the pawl away at each revolution.

When, however, the end of the record is reached and the spiral "run-in" groove gives the pick-up arm a more rapid movement, the increase in speed of movement is sufficient to cause the pawl CW to move far enough towards the turntable spindle for the tooth D to strike the face B, thus actuating the brake and operating switch of the motor.

A faint regular click is normal with this type of brake.

ADJUSTMENT OF BRAKE

If at any time the spring SP1 on the hand brake is renewed or replaced, make sure that the axis of the spring lies as far distant as possible from the centre of the pivot of the HB lever, otherwise the friction brake may fail to operate in conjunction with the automatic stop. If auto brake does not function increase the friction at BR by removing the Isle-o'-Man washer and bending the arms in order to increase the effective thickness. Too much friction at BR may cause a hollow knocking sound to be transmitted to the pick-up, and may also cause undue record wear. If a knocking sound is heard from speaker, slightly decrease the friction at BR, but do not apply oil.

TONE MONITOR

On Model 429, when in use as an Electric Gramophone, the Tone Monitor is effective only in the three middle positions, i.e., "NORMAL," "BASS," and "SPEECH." The "speech" position may be found useful when playing at great volume records which have very heavy bass passages, such as certain organ recordings. The "Bass" position will reduce surface noise on old or worn recordings.

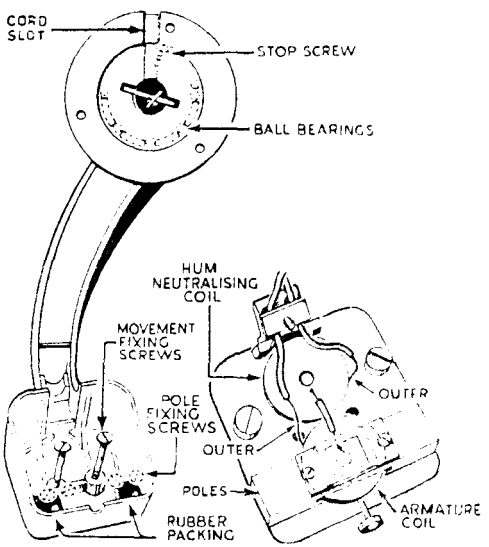


Fig. 1

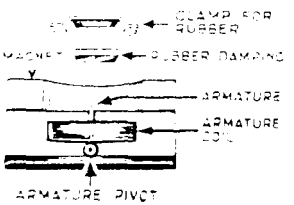


Fig. 2

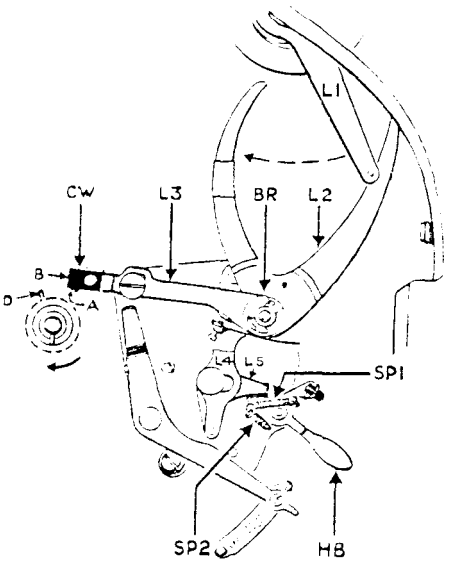


Fig. 3

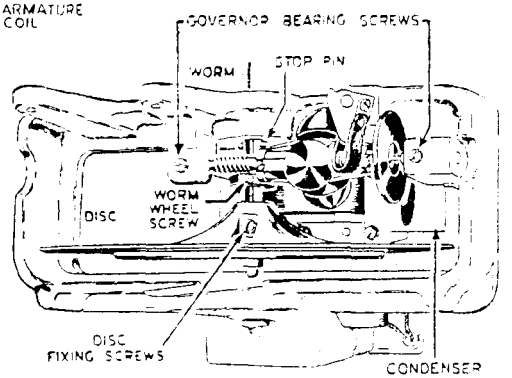


Fig. 4

ADDITIONAL DATA

Any further Service Information desired can be obtained by addressing an inquiry to The Service Department, The Gramophone Co. Ltd., 2 Parramatta Rd., Homebush, N.S.W

TECHNICAL SPECIFICATION

VOLTAGE RANGE

200 to 250 volts, 40 to 60 cycles.

It is important that the receiver be operated at the correct voltage; the voltage taps on the mains transformer should be utilized as follows:

Voltage of A.C. Supply.	Use Tap Designated.
200-220 volts	200
221-240 ,,	240
241-260 ,,	260

CONSUMPTION

	Radio	Gram.
Model 409	96 watts	—
Model 429	96 ,,	170 watts

WAVE-LENGTH RANGE

13.9 metres (21.57 megacycles) to 47 metres (6.38 megacycles).

187 metres (1600 kc.) to 545 metres (550 kc.).

MAX. UNDISTORTED POWER OUTPUT

7 watts.

DIMENSIONS

	Height	Width	Depth
Model 409 ..	35½"	30½"	13¾"
Model 429 ..	34"	34"	19¾"

WEIGHT

	Nett	Gross
Model 409	76 lbs.	93 lbs.
Model 429	115 ,,	224 ,,

LOUDSPEAKER

Model 409 uses a 10" speaker, and Model 429 a 12" speaker, the field winding acting as filter choke.

D.C. resistance of field coil, cold	1200 ohms.
D.C. resistance of voice coil ..	2 ,,
400 cycle impedance of voice coil	2.35 ,,

VALVES

6J8G, 6U7G, 6H6G, 6B8G, 6L6G, 5Y4G.

CIRCUIT

These models are superheterodynes incorporating a fairly conventional frequency-changing circuit using a 6J8G triode-heptode converter valve. The oscillator circuit is designed to provide relatively constant oscillation amplitude over the very wide tuning range incorporated in the short-wave band. The frequency changer is followed by a single-stage I.F. amplifier using a 6U7G operating at 460 kc., and feeding into a 6H6G double-diode valve. One diode of this valve is used as demodulator, and the remaining diode functions in the "Static Limiter" circuit. The demodulated signal passes through the volume control to a 6B8G diode-pentode used as A.F. amplifier, which is resistance-capacity coupled to a 6L6G beam-type output valve. One diode of the 6B8G is utilized to provide AVC voltage, being fed from the plate of the I.F. amplifier.

The broadcast band aerial coupling is through a Litz-wound iron core coil of exceptionally high efficiency. All I.F. transformers also employ Litz-wound iron core coils and silver-coated titanium dioxide fixed condensers, tuning being accomplished by axial adjustment of the iron cores.

I.F. coupling between frequency changer and I.F. valve is through a three-circuit band-pass arrangement in the interests of higher selectivity; coupling between the first and second coils is magnetic and between the second and third coils capacitive, the third coil being contained in a separate shield can. Two degrees of selectivity are provided, under control by the Tone Monitor, through the medium of tertiary windings on the I.F. transformers, that on the first transformer being used to provide additional coupling in the broad position, while the second stage tertiary acts as a magnetic screen when short-circuited, so loosening the coupling. The third transformer has an additional compensating winding which is switched into circuit when the tertiary is open.

Inductive padding of the oscillator circuit is used on the broadcast band; on the short-wave band no padding adjustment is required. Special close tolerance fixed padding condensers are used.

A.V.C. voltage is applied to the frequency-changer, and I.F. amplifier on both wave-bands. A fraction of the A.V.C. voltage is also applied to the 6B8G A.F. valve.

Inverse feed-back is applied to the complete A.F. system, through the Tone Monitor control, from the secondary of the output transformer to a tap on the volume control; in this way the whole of the A.F. circuits benefit from the distortion-reducing properties of such feed-back. In addition, the circuits associated with the Tone Monitor switch provide varying degrees of feed-back differing with frequency, thus providing control of tonal balance. Furthermore, the degree of feed-back varies with the setting of the volume control in such a way as to provide the best response for both local and distant reception, and at all volume levels. All valves are self-biassed by cathode resistors. The speaker field winding is used as a filter choke, in conjunction with two 16 mfd. wet type electrolytic condensers, one of which is of the regulating type. It is essential that the positions of these condensers in the circuit shall not be interchanged. The condensers are mounted on the speaker, and are thus protected against damage if the speaker plug is withdrawn while the receiver is in operation.

CIRCUITS

The circuit diagrams of Models 409 and 429, together with all component values, are shown on pages 4 and 5.

WAVE-BAND SWITCHING

This is carried out by means of a two-deck switch. The oscillator primary coils are connected in series and not switched. Additional capacitive feed-back is applied across the padding condenser on the short-wave band, and this is switched by contacts on the wave-change switch.

The first position of the switch (extreme anti-clockwise) connects the short-wave coils and associated components, and the second position the broadcast circuits, while in the third position the pick-up sockets are connected in circuit, and the radio circuits disconnected.

TONE MONITOR

This is a five-position two-deck switch. In Model 409 the following effects are secured in the various switch positions:

1st Position (Wide Range): Bass and treble boost, and broad tuning, for highest fidelity.

2nd Position (Normal): Bass and treble boost, and sharp tuning. For normal and distant reception.

3rd Position (Bass): Bass boost and treble cut, with sharp tuning. For deeper tone, and reduction of static and surface noise.

4th Position (Speech): Bass cut and treble boost, with sharp tuning. For long-distance reception of speech with good intelligibility, or reduced bass response.

5th Position (Overseas): Bass and treble cut, with broad tuning. For easy short-wave tuning with reduced background noise and freedom from microphony.

In Model 429, additional bass boost is provided, which is cut in by the Radio-Gram. switch in the "Gram." position, and removed in the "Radio" position.

STATIC LIMITER

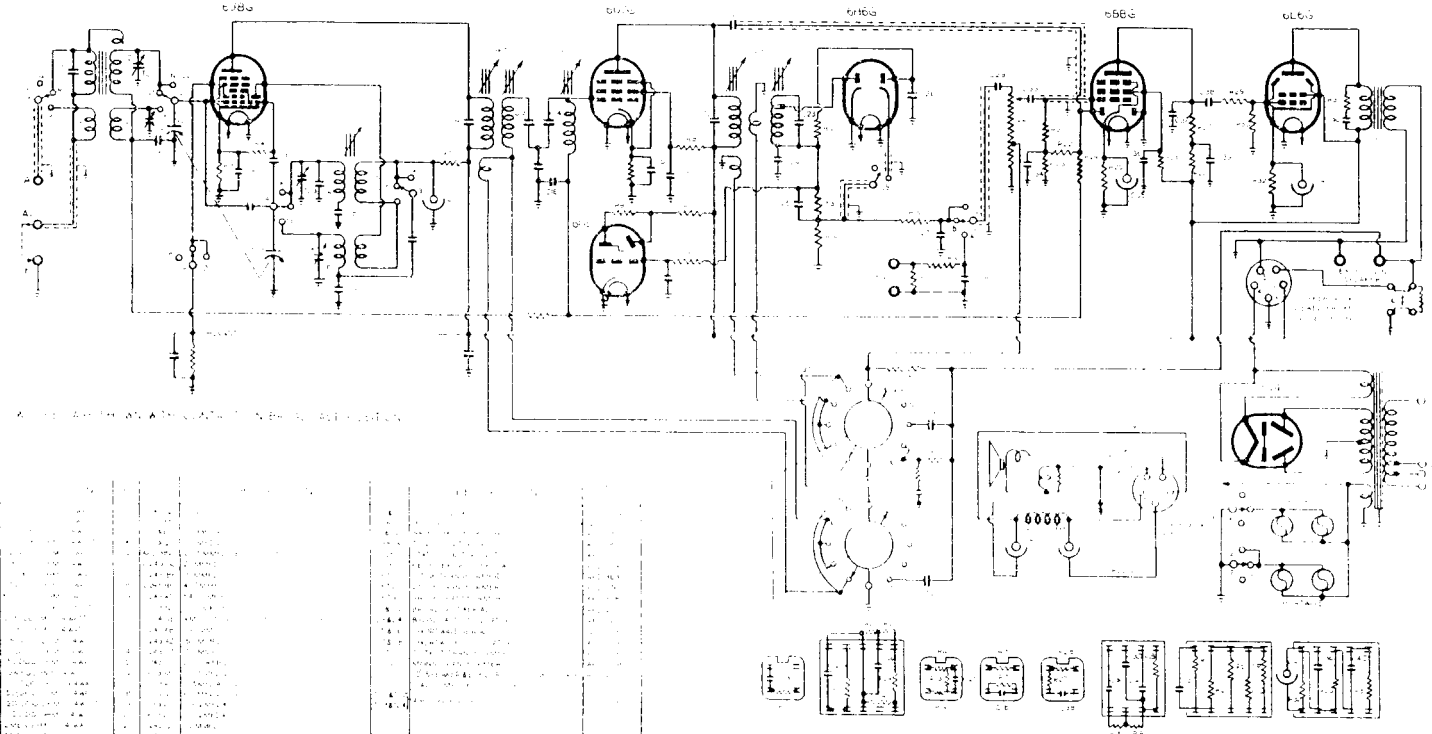
This device is controlled by a switch located on the right-hand side of the cabinet, in the case of Model 409, and on the control panel in Model 429. It is intended to limit the peak level of static or electrical disturbances of peaky wave-form to a value not greatly exceeding the level of the carrier of the station being received, thus preventing the drowning of the signal by very loud bursts of static. It is useful chiefly in long-distance reception of speech, and in short-wave reception where electrical interference is severe. It usually has a slightly detrimental effect on the tone of musical reception, and should therefore be switched off when not required. It has no effect on the sensitivity or selectivity of the receiver.

EXTENSION SPEAKER

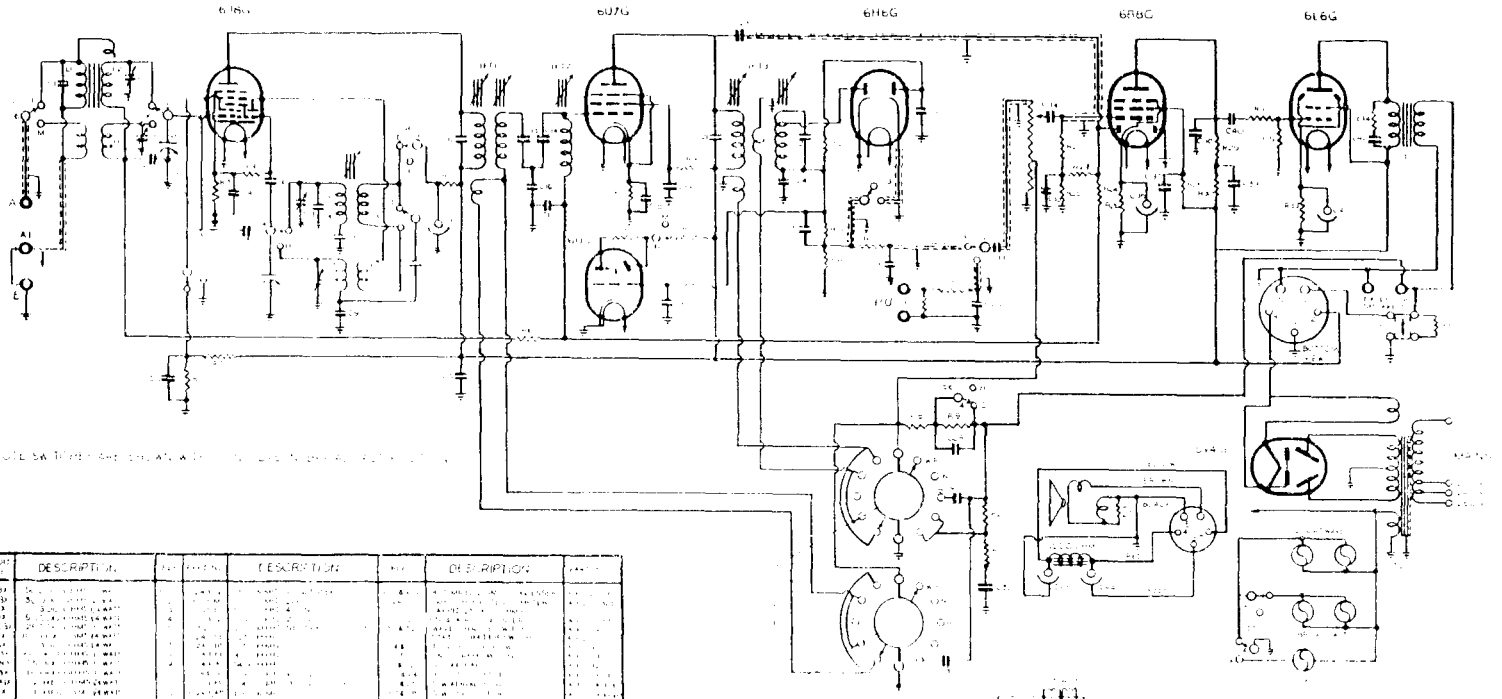
Pin-jacks are provided at the back of the chassis for the connection of an extension speaker. They are wired to the secondary of the output transformer, and are suitable for connection to any loudspeaker having a voice coil impedance between 2.5 and 4 ohms. An impedance of 3 ohms at 400 cycles is recommended, and the speaker should preferably be of permanent magnet type, and requires no transformer. The "His Master's Voice" Extension Speaker is very suitable, and is fitted with a constant impedance volume control. A switch, marked "REC'R SPKR," is installed beside the jacks to permit the receiver speaker to be silenced if desired when an extension speaker is in use.

PRELIMINARY TESTS

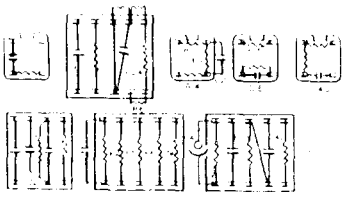
1. Switch on receiver and note that dial lights up and changes colour when wave-band switch is operated.
2. If no signals can be tuned in, remove the shield from the 6B8G valve and with the volume control full on and earth wire disconnected, touch the finger to the grid cap of the valve, when a loud hum should be heard; a hum should also be heard with wave-change switch at "Gram.", when the red pick-up jack is touched. This indicates that the A.F. side of the receiver is working, and the fault probably lies in the R.F. or I.F. circuits. Should no hum be heard ,a fault exists between first A.F. stage input and the speaker.
3. Check all valves for heater continuity and freedom from internal shorts.
4. To determine if the fault lies in the loudspeaker, connect a high impedance A.C. voltmeter or output meter, range 0–3 volts approx. to the voice coil terminals of the speaker. Switch on receiver, turn volume control fully on, and tune across the broadcast band when stations are known to be transmitting. If meter does not deflect, the fault lies in the receiver circuits or in the field circuit of the speaker. If the meter deflects but no sound is heard, the speaker voice coil is at fault.
5. If the fault is still undiscovered, remove chassis and speaker from cabinet and compare voltages with table given on page 6.

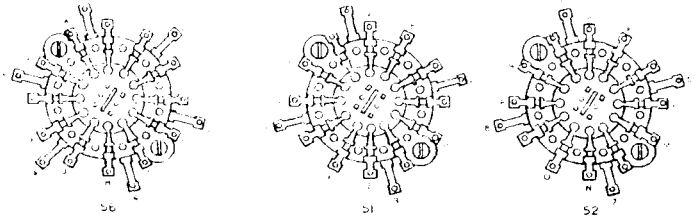


Dual Wave A.C. Receiver, Model 409.



REF.	PART NO.	DESCRIPTION	REF.	PART NO.	DESCRIPTION	REF.	PART NO.	DESCRIPTION





Dual Wave A.C. Radiogram, Model 429.

DISMANTLING

REMOVAL OF CHASSIS

1. Remove knobs. (Knobs without screws pull straight off shaft. Do not lose spring from inside small tuning knob.)
2. Disconnect speaker plug and power plug.
3. Remove nut from Static Limiter Switch and withdraw switch from escutcheon. Free switch cable from cleats on shelf.
4. Remove nuts from two fixing bolts from underside of shelf; the chassis is now free.

REMOVAL OF LOUDSPEAKER

1. Remove 5-pin plug from back of chassis.
2. Remove four screws holding speaker chassis to baffle and withdraw speaker.

VOLTAGE TABLE

Values given are ± 10% with receiver tuned to point of no reception, broadcast band, with line voltage of 240 volts (mains transformer primary tap set for 240 volts). If a voltmeter having a resistance of less than 1000 ohms per volt is used, allowance must be made for the voltage drop caused by the voltmeter.

	6J8G						6U7G	6H6G	6B8G	6L6G	6U5	5V4G
	Amp.			Osc.								
	B.C.	S.W.	R.G.	B.C.	S.W.	R.G.						
Plate to Chassis Volts	290		292	150	140	148*	290	—	50	275	270	390 A.C.
Screen to Chassis Volts	120	122	0	—	—	—	115	—	20	290	30	—
Plate Current M A	1.6	2.2	0	5.3	6.9	—	9.0	—	0.4	78 ma Total	0.6	—
Screen Current M A	3.2	3.0	0	—	—	—	2.3	—	—		—	—
Heaters	—	—	6.3	—	—	—	6.3	6.3	6.3	6.3	6.3	5.0
Cathode to Chassis Volts	3.0	3.2	1.6	3.0	3.2	1.6	3.6	—	1.5	14.0	—	—

Input Volts to Filter	420 v.
Output Volts from Filter	290 v.
Total H.T. at Speaker Socket	110 ma.

*On Model 429, Osc. Plate Volts 0 on "Gram."

RADIO FREQUENCY TESTS AND ADJUSTMENTS

Instability, insensitivity or poor selectivity indicate that the alignment of the tuned circuits is not correct. If a coil or other component associated with the R.F. or I.F. circuits of the receiver has been replaced or repaired, or if the wiring has been disarranged, all circuits must be realigned.

To do this, the following apparatus is required:

1. An oscillator or signal generator capable of tuning to 460 kc., 1500 kc., 600 kc., 13.9 metres (21.57 mc.) and 15 metres (20 mc.), suitably screened and having an attenuator.
2. An output meter having a range of 0-2 volts AC approximately.

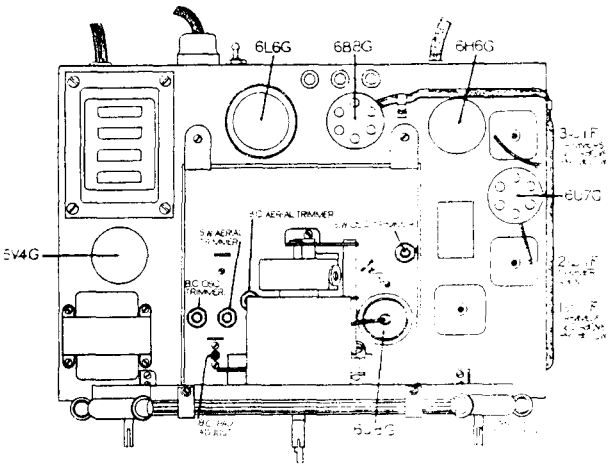
I.F. alignment should always precede R.F. alignment, and even if only one coil or one range of coils has been serviced, the whole of the realignment should be done in the order given, i.e., broadcast band first followed by short-wave band.

In carrying out the following operations, it is important that the input to the receiver from the oscillator should be kept low and progressively reduced as the circuits are brought into line, so that the reading on the output meter does not exceed about 1.0 volt.

For all alignment operations, the output meter should be connected directly across the voice coil terminals of the speaker.

I.F. ALIGNMENT

The sketch below shows the layout of all principal components and adjustments referred to in the following procedure.



Before commencing alignment, it is essential to set the Tone Monitor switch to the "Normal" position.

Rotate volume control fully clockwise, and set wave-change switch to "Broadcast" position; rotate tuning control till dial pointer indicates 550 kc., i.e., condenser vanes fully meshed. Connect output leads of signal generator to the grid cap of the 6J8G through a 0.1 mfd. condenser and to the receiver chassis or earth terminal. (Note.—Do not disconnect the clip and lead from the 6J8G grid.)

Temporarily connect a 50,000 ohm ½-watt resistor from the A.V.C. diode connection on the 6B8G socket to ground, keeping the resistor close to the socket and away from chassis or other components. The socket contact referred to can be identified by its metal-shielded connection.

1. Tune signal generator to exactly 460 kc
2. Adjust the trimmer screws of the I.F. transformers for maximum deflection of the output meter, commencing with the third I.F transformer, and following with the second and first in turn. Reduce the input from the signal generator as the work proceeds, to keep the output meter reading at about 1 volt or less.
3. Continue this alignment **very carefully** on each transformer in turn until no greater output can be obtained. It is necessary to completely align all transformers at least twice, preferably three times.
4. When alignment is completed, remove 50,000 ohm resistor from A.V.C. diode. After removal do not touch trimmers.

(**Note.**—If trimmer screws are screwed too far in, it is possible to obtain a false peak due to coupling effects between the moveable iron cores. Any trimmer which appears to require screwing too far in should be screwed out considerably and the true peak will then be found.)

R.F. ALIGNMENT

With controls set as for I.F. alignment, connect the signal generator output leads through a standard dummy aerial of 200 mmf. capacity to the aerial and earth terminals.

Check that when the ganged condenser is fully meshed, the pointer falls directly over the setting line, marked "S" at the extreme bottom right of the scale; the pointer is a friction fit on the condenser spindle, and can be rotated to bring it to the correct setting.

1. Tune signal generator to 600 kc.
2. Rotate tuning knob until dial pointer is exactly over 600 kc., mark on scale, and by means of padding adjustment (brass screw to left of ganged condenser) align receiver so that the 600 kc. signal is tuned in exactly on 600 kc. dial calibration.
3. Tune signal generator to 1500 kc.
4. Set pointer exactly over 1500 kc. mark on dial and adjust B c oscillator trimmer until the signal is tuned in with the pointer on the 1500 line.
5. Adjust B C aerial trimmer for maximum output on output meter, "rocking" ganged condenser slightly during adjustment if necessary.
6. Repeat operations 1 to 5 inclusive. THIS IS IMPORTANT. Note that any stations receivable are tuned in correctly on calibration. (Discrepancies of two or three kilocycles can be tolerated).

SHORT-WAVE ALIGNMENT

1. Set wave-change switch to S.W. range (fully anti-clockwise). Remove the standard dummy aerial from the output lead of the signal generator, and substitute a 400-ohm non-inductive resistor; connect to aerial terminal as previously.
2. Tune signal generator to 13.9 metres (21.57 mc.).
3. Rotate tuning knob until pointer is over 13.9 metres on dial, and adjust S.W. oscillator trimmer until maximum output is obtained with pointer exactly on the 13.9 metre mark. Two settings will be found at which this trimmer will peak; care must be taken that the setting finally selected is that which gives the lower capacity, i.e., plunger further out. Failure to select the correct position of the two will cause serious tracking errors and loss of sensitivity.
4. Tune receiver and signal generator to 15 metres (20 mc.).
5. Adjust S.W. aerial trimmer for maximum output while "rocking" the ganged condenser slightly to obtain the true resonant point.
6. Retune receiver and signal generator to 13.9 metres, and note that signal is still tuned in correctly on dial; if not, readjust S.W. oscillator trimmer slightly until dial reads correctly, and then repeat tests 4 to 6 inclusive.

7. Check foregoing adjustments carefully to ensure that correct settings have been obtained on all trimmers. Dial should now read correctly throughout.

Note.—The R.F. trimmers on these models are of plunger type with air dielectric, and possess exceptionally high stability and efficiency. A special adjusting tool can be obtained from the factory,

incorporating a box spanner for the condenser lock-nut and an adjusting hook for the plunger. After loosening the lock-nut at the top of the condenser, the adjusting hook is inserted in the hole which will be found in the top of the plunger, which can then be easily adjusted by moving up or down as required with a slight rotary movement. When adjustment is completed, tighten the lock-nut securely.

TECHNICAL SPECIFICATION

PICK-UP

DC resistance, 7,400 ohms.

Impedance at 1000 cycles, 19,000 ohms.

One of the pick-up leads, and also the screening over the leads, is to be connected to the black pick-up socket on the chassis. For service particulars of this pick-up, see below.

AUTO BRAKE (Type 324)

Standard friction type, see page 10.

DISMANTLING

REMOVAL OF CHASSIS

1. Remove knobs. The tuning control knobs are a friction fit and can be pulled off. Do not lose small flat spring from inside small tuning knob.
2. Disconnect loudspeaker plug, gramophone motor plug, tuning indicator socket, and pick-up leads. (Socket pulls straight off base of tuning indicator tube.)
3. Unscrew volume control bracket from inside front of cabinet.
4. Remove nuts from static limiter and speaker switches on top of control panel, and withdraw switches, noting position so that they may be replaced right way round.
5. Remove two nuts from chassis fixing bolts behind wooden chassis supports; the chassis is now free.

THE PICK-UP AND MOTOR

To gain access to the pick-up movement, remove the wax covering the two screw-heads in centre (under-side) of pick-up head and remove the screws. The four wax-covered screws fixing the pole pieces of the pick-up must not be disturbed. These pole-fixing screws are situated at either side of, and in line with, the needle hole (Fig. 1).

ADJUSTING THE ARMATURE

The armature, which should be midway between the two poles of the magnet, may be adjusted by moving the clamp which holds the rubber damping pad.

See that the slit in the rubber is locating the end of the armature. When properly fitted, the flat end of the armature will be just visible through the slit in the rubber. Carefully remove all dust or filings in and around the gap of the armature. A piece of "plasticine" will be found useful for this work.

THE MAGNET

Do not remove the magnet unless absolutely necessary.

If it is necessary to remove the magnet, first place a "keeper" consisting of a flat piece of iron across the poles of the magnet. When replacing, the ground face of the magnet must be in contact with the poles.

RENEWAL OF COILS

Be careful to connect and position the coils correctly (see Fig. 1) when renewing. These coils should be firmly held in position with beeswax.

THE MOTOR

To remove the motor on the radiogram: First disconnect leads, then remove the three fixing screws from the top of the motor-board (underneath turn-table), taking care not to lose rubber washers between motor and board.

LUBRICATION

It is important that only good quality light machine oil and grease, free from acid, should be used for lubrication. It is advisable to lubricate the motor regularly on certain dates, depending on how much it is used; the oiling diagram will be found inside the cabinet.

THE AUTOMATIC BRAKE

THE AUTOMATIC BRAKE

How it Works. (Read carefully before attempting adjustments.) Fig. 3.

The pick-up arm travels across the record until the point is reached when lever L1 slowly commences to push lever L2 (rubber-covered arm). This slight movement is transmitted to the brake lever L3 by the friction bearing BR. Note the correct position of tone arm lever L1 in the fork of lever L2. So long as the needle progresses over the record at the normal rate (obtained only by the actual playing of a record) the movement of the pick-up arm is not enough to move L3 sufficiently for the pawl CW to engage fully with the tooth D on the frictional collar