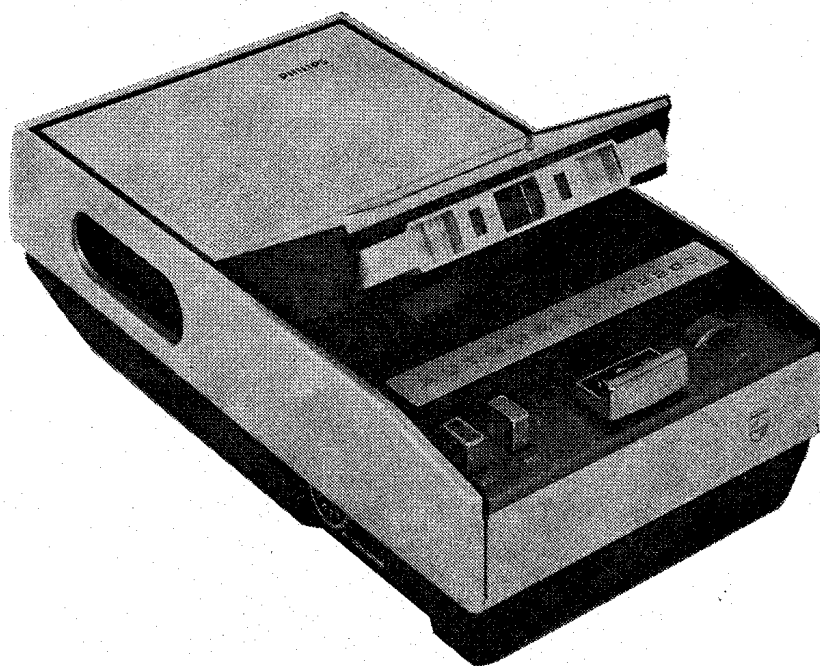


## TAPE RECORDER

SERVICE INFORMATION FOR THE

# PHILIPS

## N2203



---

**CES**

**COMBINED ELECTRONIC SERVICES LIMITED**

604 PURLEY WAY · WADDON · CROYDON · CR9 4DR

TELEPHONE: 01-686 0505

(Recorded messages after business hours)

TELEX: 262308

DECEMBER, 1972

(Please quote model number when ordering further copies)

726 17011

## CONTENTS

	Page No.
A — INTRODUCTION	1
B — SPECIFICATION	1
C — ACCESSORIES	3
D — OPERATION	3
E — DISMANTLING	3
F — MECHANICAL DESCRIPTION	3
G — MECHANICAL REPLACEMENTS AND ADJUSTMENTS	5
H — CLEANING AND LUBRICATION	10
I — ELECTRICAL DESCRIPTION	10
J — ELECTRICAL CHECKS AND ADJUSTMENTS	10
K — MICROPHONE AND REMOTE CONTROL SWITCH	12
L — SPARE PARTS LIST	13

### A—INTRODUCTION

The N2203 is a portable, cassette type, tropicalised, battery powered tape recorder, employing 11 transistors together with 6 diodes. 'On-Off' switching, and all tape transport functions are controlled by a multi-directional sliding knob; a rotary knob is provided for volume control. Two push buttons are fitted, one for 'Cassette release', the other for 'Record' switching. An edge-scale type moving coil meter performs the dual functions of battery condition indicator/recording level indicator.

A special feature of the recorder is the incorporation of automatic recording level control, hence no manual recording level control is fitted.

Recording facilities include recording from a microphone, a radio, a record player, or a second tape recorder.

Provision is made for playback by way of the internal loudspeaker, an external loudspeaker, an external amplifier and loudspeaker, or a headphone set.

Remote start-stop control is afforded by an integral switch on the N8210 microphone, which is supplied with the N2203, together with a carrying case, a connecting lead EL3768/10, and a C-60 cassette.

### B—SPECIFICATION

<b>Cabinet</b>	Silver and grey aluminium top and sides, with textured black polystyrene underbody.
<b>Cabinet dimensions</b>	8" x 4 $\frac{5}{8}$ " x 2 $\frac{1}{4}$ " (203 x 118 x 57 mm.)
<b>Weight</b>	1.15 kgs. (2.5 lbs.)
<b>Battery supply</b>	7.5V (5 x 1.5V) HP11 or equivalent.
<b>Tape system</b>	Philips Compact Cassette.
<b>Tape speed</b>	1 $\frac{7}{8}$ i.p.s. (4.76 cm/s).

### Forward wind/

**Rewind time** <70 seconds for a C-60 cassette.

**Frequency response** 80–10kHz (within 6dB).

**Signal/Noise ratio** > 45dB.

**Wow and flutter** <±0.4% DIN.

**Output power** 500mW (±1dB).

**Loudspeaker** 2.5" (63 mm.) diameter, 8Ω.

**Bias and Erase frequency** 48–58kHz.

**Recording level/battery indicator** Moving coil meter. Automatic recording level control.

**Programme indicator** Scale on cassette visible through cassette compartment lid.

**Microphone** Omni-directional moving coil with start/stop switch.

The right is reserved to alter the specification without prior notice.

### Input/Output sockets Socket 1 (6 pole 180° DIN)

Input: Microphone 0.2mV/2kΩ  
pins 1,4, and 2 (earth)

Gramophone and Radio 100mV/1MΩ  
pins 3,5, and 2 (earth)

Output: Output for 0.5V/20kΩ

Amplifier, Radio pins 3,5, and  
2 (earth)

Test point 1 pin 6 and 2 (earth)

### Socket 2 (6 pole 240° DIN)

Input: Mains supply unit 7.5V (N6502)  
pin 1 positive, pins 2,3, negative

Output: Headphones 200mV (constant)  
1.5kΩ pins 4 and 2,3 (earth)

Remote stop start switch pins 1 and 5  
Test point 2 pin 6 and 2,3 (earth)

### Socket 3 (2 pole DIN)

Output: External loudspeaker 500mW  
8Ω



## C—ACCESSORIES (not supplied with the recorder)

Microphone connection/ extension lead	N6206
Cassette cleaning tape	811/CCT
Mains supply unit	N6502
Mono headphones	N6308
Loudspeaker enclosure	22RH411/00 (8 $\Omega$ version)
Car tray	N6705

### Note:

Recorder N2203 is very suitable for use in car tray N6705 provided the car employs a negative earth electrical system.

## D—OPERATION (see Fig. 1)

Detailed operating instructions are supplied with every recorder.

### 1. Record

Hold down red button 102 and push tape transport control knob 101 forward. No manual control of recording level is required, this function being performed by electronic components. On completion of recording, pull the tape transport control knob backwards, stopping the tape transport and automatically re-setting record button 102 to its rest position.

### 2. Playback

Push tape transport knob 101 forwards and adjust volume control 106 to the required sound level. To stop playback, pull the tape transport knob backwards.

### 3. Forward wind and Rewind

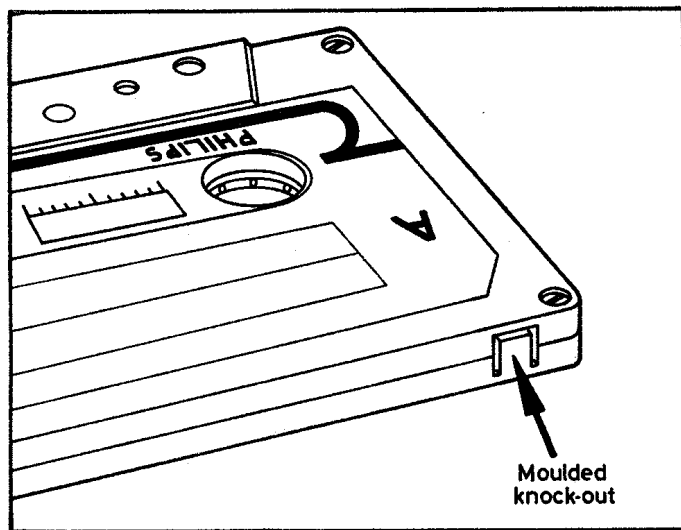
Move the tape transport knob to the left or right as required.

### 4. Safeguard against accidental erasure

With a screwdriver or other suitable object break out the small moulded knock-out on the back of the cassette opposite the A (for a recording on side A), or opposite the B (for a recording on side B), see Fig. 2. Thereafter with the cassette in the recorder recording button 102 cannot be depressed, thus the modified cassette can only be played back.

### 5. Cassette release

Upon depressing cassette release button 103, cassette holder/cover 109 automatically lifts the cassette clear of the recorder



SD 4371

Fig. 2

mechanism into a position convenient for its removal. Internal locking arrangements prevent button 103 from being depressed when knob 101 is in the forward (record or playback) position.

## E—DISMANTLING

### 1. Cabinet removal (see Fig. 1)

Remove the cassette, battery cover 116, the batteries, bottom plate 107, and pull off tape transport knob 101. Withdraw the screws (4) securing the chassis/battery holder assembly to the cabinet assembly. The chassis/battery holder assembly is now free to be removed from the cabinet assembly, captive only by the loudspeaker leads. Re-assemble in the reverse order.

### 2. Printed panel removal

Uncase the machine as per para. 1 above. Remove the two screws located one at each end of the amplifier panel, and slacken the screw securing the volume control bracket to the chassis. The printed panel may now be turned through 90°, giving sufficient access to the component side of the panel to enable repairs to be carried out, or it may be removed completely by unsoldering the various connecting leads.

When refitting the panel, ensure that the lower end of switch lever 63 engages with the slider of Switch 1.

The motor control panel may be removed by releasing the two securing screws located one at each end of the panel.

## F—MECHANICAL DESCRIPTION

### 1. Playback (see Figs. 1 and 3).

When tape transport knob 101 is pushed forwards, carriage plate 300 moves erase head 55, record/playback head 56, and pressure roller 83 into contact with the tape. A felt pad in the cassette maintains adequate pressure between the tape and the record/playback head. Simultaneously bracket assembly 69 moves switch plate 89 against Switch 3 and closes contacts 5-4, 1-2 and 7-6, supplying current to the motor and the amplifier.

Motor 88 drives the idler wheel of clutch assembly 87 and fly-wheel 72 by means of drive belt 75. As carriage plate 300 moves forwards, it releases clutch assembly 87, which moves under influence of spring 86 into contact with the R.H. turntable to provide a slipping drive for tape take-up. The idler wheel on idler wheel bracket assembly 73 is brought into contact with the L.H. turntable and provides tension to the tape.

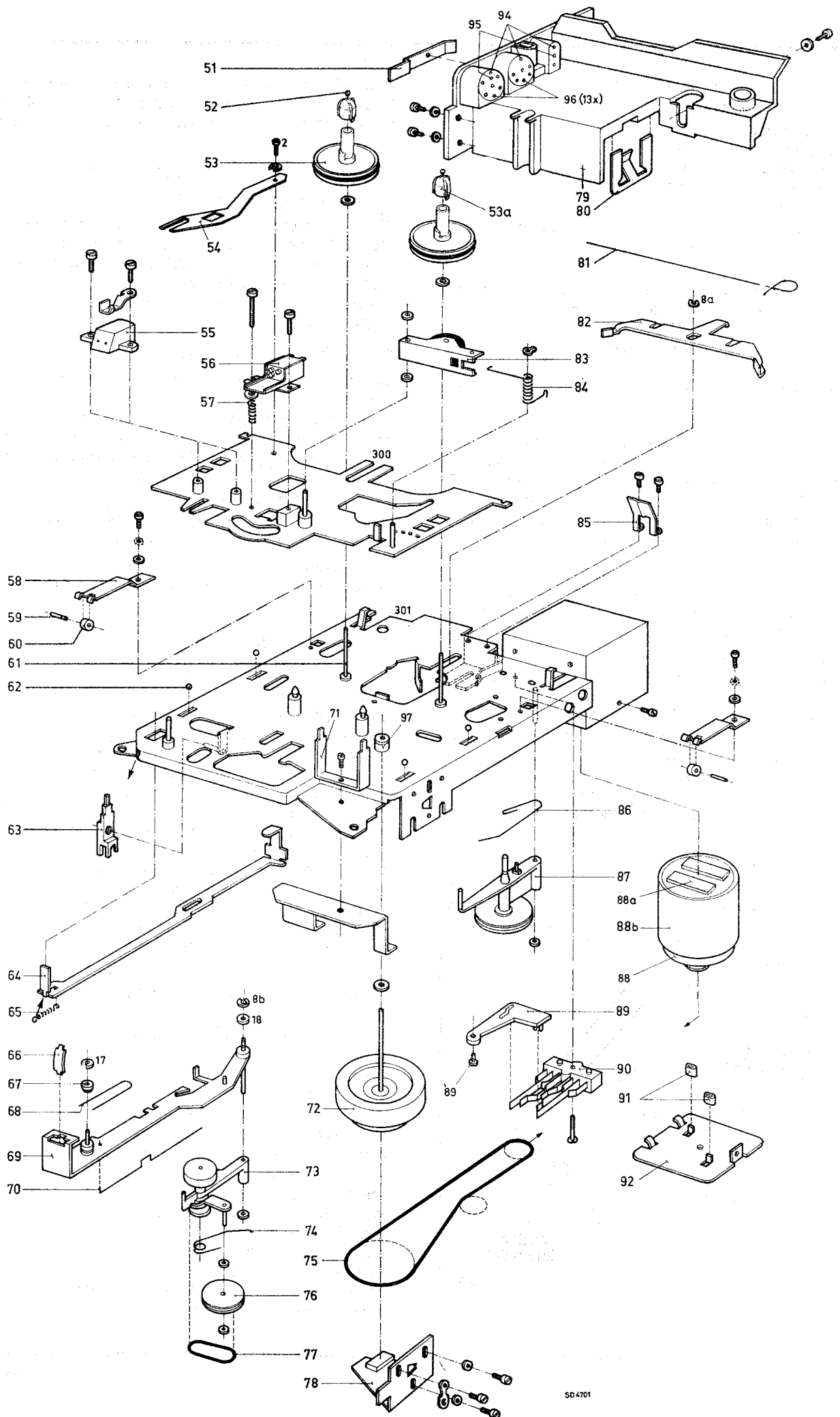
Bracket assembly 69 moves brake bracket 82 away from the turntables against the opposition of spring 81.

The head of screw 2 (securing leaf spring 54) operates locking bracket 115, preventing cassette release button 103 from being depressed.

### 2. Record (see Fig. 3)

All mechanical operations for 'Playback' apply.

The 'Record' button cannot be depressed unless record interlock bracket 64 has been moved backwards by the insertion of a cassette on which the small moulded knock-outs are still intact (see para. D (4) above). If this is the case, when record button 102 is depressed, it deflects leaf spring 54 over the end of switch operating lever 63. Thus, when tape transport knob 101 is moved forwards, leaf spring 54, attached to carriage plate 300, moves forwards and causes switch operating lever 63 to switch S1 to the 'Record' position. S1 is returned to the 'Playback' position when tape transport knob 101 is pulled backwards.



50 4701

Fig. 3 Mechanical Assembly—Exploded View

### 3. Forward wind

When tape transport knob 101 is moved to the right, bracket assembly 69 is moved forwards releasing brake bracket 82 from the turntables, and, via switch plate 89 closes Switch 3 contacts 4-5, 1-2 and 6-7, supplying current to the motor. Idler wheel on bracket 73 comes into contact with the R.H. turntable. Drive pulley 76 is driven by flywheel 72, and drives via belt 77 the pulley on the idler wheel spindle.

### 4. Rewind

For this position tape transport knob 101 is moved to the left. Mechanically the action is similar to that for 'Forward wind' above, except that the idler wheel on bracket 73 is brought into contact with the L.H. turntable and Switch 3 contacts 4-5, 2-3, 7-8 are closed, reversing the polarity of the supply to the motor, hence driving it in the opposite direction.

## G—MECHANICAL REPLACEMENTS AND ADJUSTMENTS

### 1. Replacements (see Fig. 3)

#### (a) Main drive belt 75

Remove flywheel lower bearing bracket 78 (3 screws), and motor retaining plate 92 (1 screw). Drive belt 75 can now be removed. Replace in the reverse order.

#### Note°

When refitting flywheel lower bearing bracket 78 ensure that the axial play of flywheel 72 is not less than 0.1 to 0.2 mm. This adjustment is effected by inserting a screwdriver blade into the triangular slot in the lower bearing bracket and easing the bracket up or down as required (see Fig. 4). Tighten the three securing screws firmly after making this adjustment.

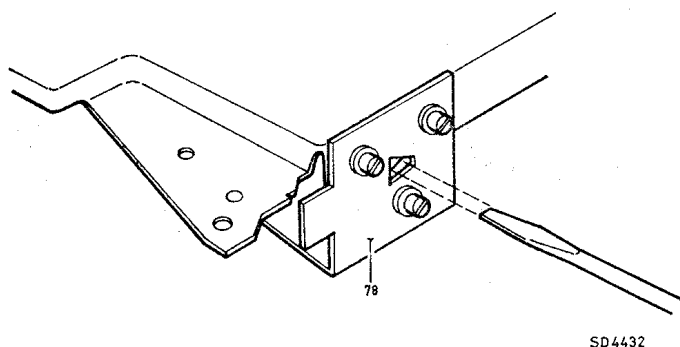


Fig. 4

#### (b) Flywheel 72 and clutch assembly 87

Remove flywheel lower bearing bracket 78 and free the drive belt from the flywheel. Remove the motor control printed panel complete with support bracket (1 screw beneath recording level/battery condition meter). Ease off the nylon circlip retaining clutch assembly 87. The flywheel and the clutch assembly may now be removed together. Re-assemble in the reverse order, ensuring that the actuating peg on clutch assembly 87 engages the loop on spring 86. Adjust the flywheel axial play as described in para. (a) above.

#### (c) Motor 88

Remove motor retaining plate 92, withdraw motor 88 from its screen, disconnect motor supply leads (red and blue) from Switch 3, and remove the two ferrite beads from the leads. Replace in the reverse order.

#### Note:

- (i) After replacing the motor, its speed should be checked as described in para. 2(f) below.
- (ii) To minimise electrical interference from the motor, the two ferrite beads should be fitted as close as possible to the point where the motor leads enter the motor, additionally the beads must be positioned correctly in the motor screen, i.e. adjacent to the battery holder securing screw. (See Fig. 5).

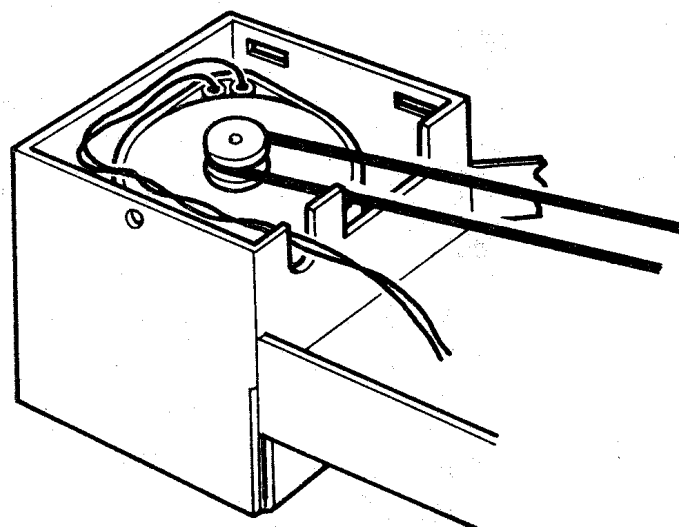


Fig. 5

#### (d) Turntable 53

Pull off top cap 52 and lift the turntable from its spindle.

#### (e) Idler wheel bracket assembly 73

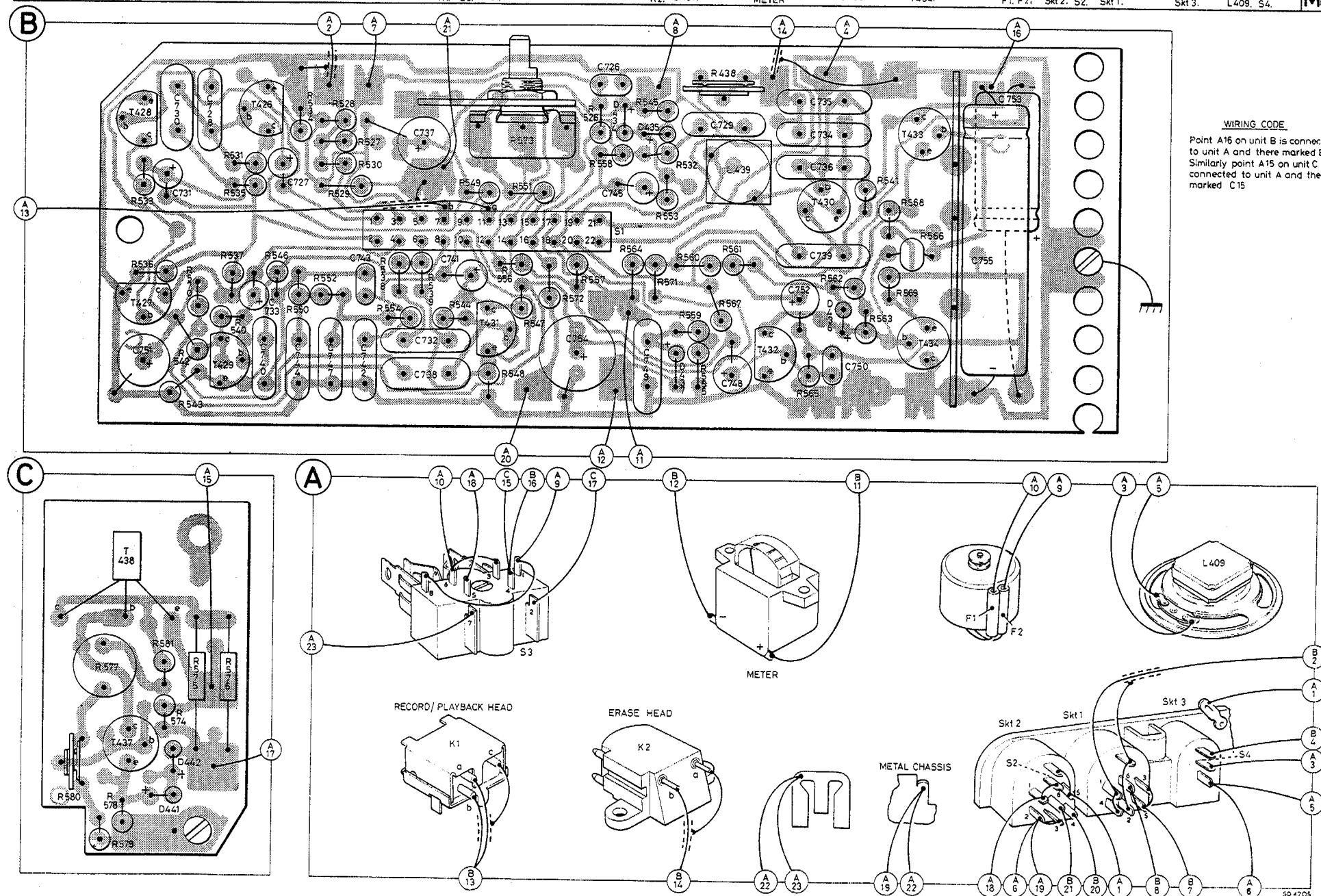
Remove flywheel 72 and clutch assembly 87 as described in (b) above. Remove circlip 17 and roller 67, then circlip 8a and brake bracket 82 together with spring 81. Finally remove circlip 8b and washer 18 from bracket assembly 69, which may now be withdrawn from chassis plate 301. Ease off the nylon circlip retaining idler wheel assembly 73, and slide the assembly free from bracket 69.

Re-assemble in the reverse order. Adjust flywheel axial play as described in para. (a) above.

## 2. Adjustments

#### (a) Pressure roller bracket 83 (see Fig. 7)

Switch to 'Playback'. The force required to pull the pressure roller away from the capstan should be 150-190 gms. Adjust by fitting the end of torsion spring 84 into any of the four adjacent locating holes provided.



**Fig. 6 Printed Panel—Component View**

**(b) Clutch assembly 87**

To check the internal friction of clutch assembly 87, switch to 'Playback', turn the volume control to minimum, then measure the total current consumption of the machine. Prevent the R.H. turntable from rotating, and note the increase in current, which should lie between 8–16mA. If this is not the case, check the adjustment given in para. (c) below. Measure the increase in current again and, if still outside the limits given above, clutch assembly 87 should be replaced.

**(c) Clutch spring 86 (see Fig. 7)**

The force required at point 'L' to pull clutch pulley away from R.H. turntable should be 70–100 gms. Adjust by bending spring 86.

**(d) Switch 3**

In the 'Off' position a small clearance must exist between all of the switch contacts. Adjust by repositioning the switch about its securing screw, and by slightly bending the contacts.

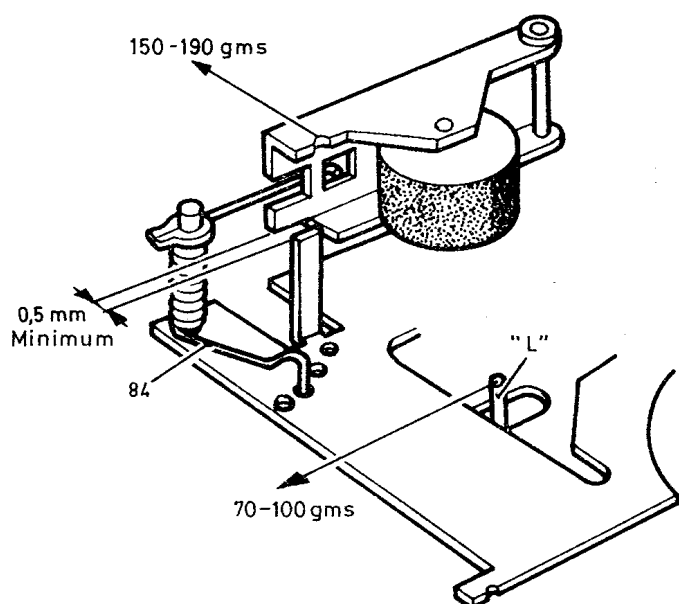


Fig. 7

SD4434

**(e) Idler wheel bracket assembly 73 (see Fig. 8)**

Switch to 'Playback'. Lug B should just clear projection D; adjust by bending lug B. Spring 74 should just clear the nylon bearing tube of bracket 73; adjust by bending lug C. The distance between drive pulley 76 and flywheel 72 should be 1–2 mm.; adjust by bending lug E. In position 'Rewind' spring 70 should just clear lug F; in position 'Forward wind' spring 70 should just clear bracket 73. Both these requirements may be met by slightly bending spring 70.

**(f) Motor speed adjustment**

The motor speed may be checked by either of two methods, using the special tape cassette (code number 8945 600 13501), or with the use of a suitable stroboscope.

**(i) Using test cassette**

Test cassette 8945 600 13501 has an 800Hz signal modulated at every 4.75 m. Insert the cassette into the recorder and switch to 'Playback'. The time between any two successive 800Hz signals should be between 95–103 seconds.

**(ii) Using stroboscope (see Fig. 9)**

To enable this method to be adopted, one side of a standard tape cassette must be removed. This can be done with the aid of a suitable knife, the burrs being removed with a small file. The motor

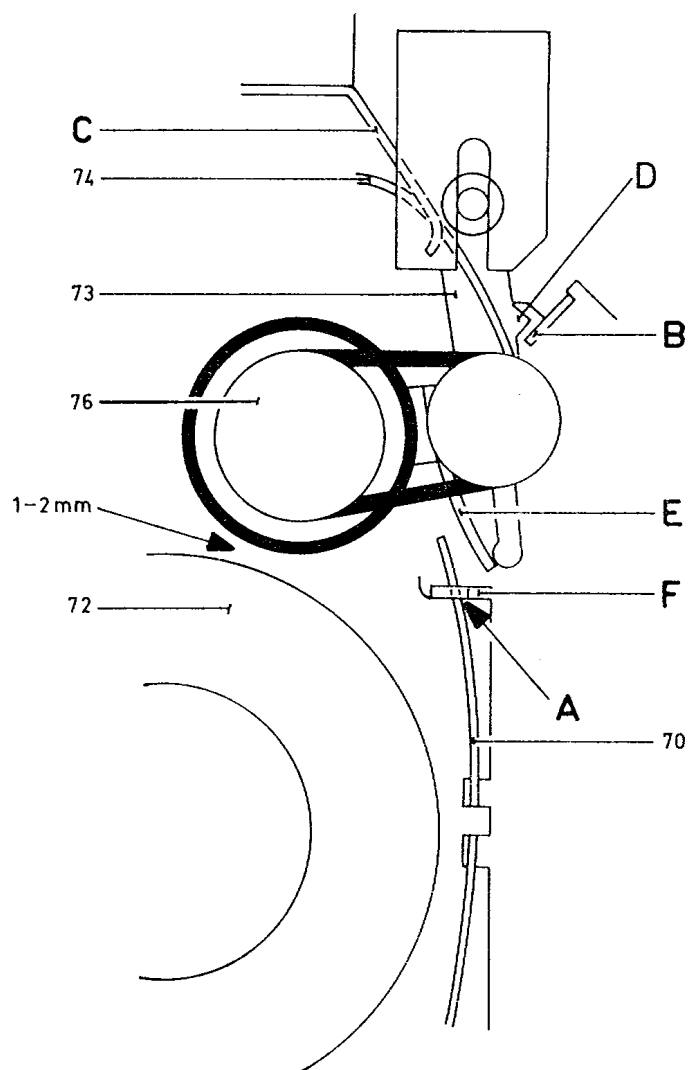


Fig. 8

SD4435

speed is checked by pulling a loop of tape from the side of the cassette and placing within the loop a suitable tape stroboscope, which should indicate a tape speed of  $1\frac{7}{8}$ "/sec. If the speed is incorrect and no obvious mechanical fault exists, adjust R580 (on the motor control panel) to obtain the correct speed.

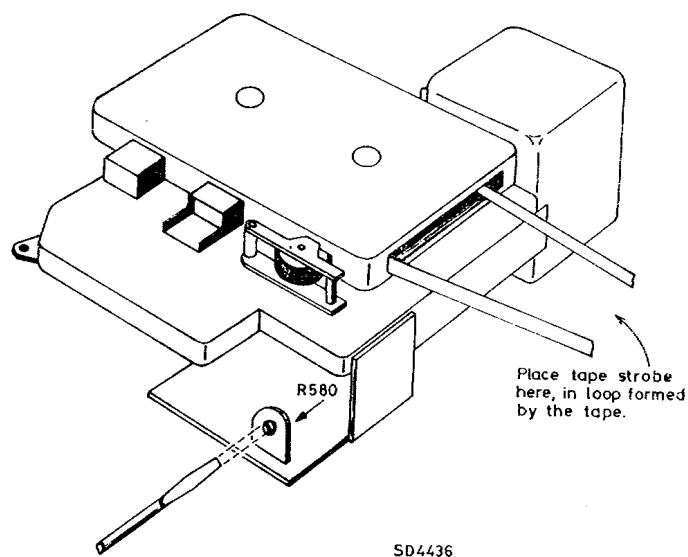


Fig. 9

SD4436







## H—CLEANING AND LUBRICATION

### 1. Cleaning

#### (a) Record/playback and erase heads etc.

Both magnetic heads and the capstan should be cleaned at regular intervals. They may be cleaned with a soft cloth wrapped around a wooden stick and moistened with methylated spirit or industrial alcohol. Metal objects must not be allowed to come into contact with the magnetic head faces.

#### (b) General

After approximately 500 hours service it is advisable to clean the following parts with methylated spirit or industrial alcohol.

- (i) Record/playback and erase head faces
- (ii) Capstan
- (iii) All drive belts
- (iv) Grooves in flywheels and pulleys
- (v) All friction drive surfaces
- (vi) Brake bracket shoes and braking surfaces of turntables

### 2. Lubrication

All machines are fully lubricated during manufacture and further attention should be normally required only after a long period of service. If this is the case, or upon replacement of any mechanical component, lubrication may be applied SPARINGLY to the positions described below. It is emphasised that excessive use of lubricant will hinder rather than assist the operation of the machine, and great care should be taken to prevent contamination of drive surfaces by any form of lubricant. Under no circumstances may the motor be lubricated.

(a) A light oil (such as Shell Tellus 33) may be applied to the following points:

- (i) Turntable spindles 61
- (ii) Shaft of roller 67
- (iii) Flywheel spindle 72
- (iv) Hub and bearing of clutch assembly 87
- (v) Hub and spindle of idler wheel bracket assembly 73

(b) A light grease (such as Shell Alvania 2) may be applied to the following points:

- (i) Sliding surfaces and extrusions of carriage plate 300
- (ii) Ball bearings 62 under carriage plate 300

## I—ELECTRICAL DESCRIPTION

(see Fig. 10)

### (a) Motor control circuit

A reduction of supply voltage or increase in motor load will initially cause a reduction of potential at the junction of D442/R575/R576. The tendency of diodes D441 and D442 to maintain a constant voltage across themselves causes this reduction in voltage to appear approximately in full at the emitter of T437. Only a small proportion of the initial voltage reduction across the motor will appear at T437 base owing to the potential divider action of R575/R576, R581, R577, R580, and R597. The resultant increase in forward bias on T437 increases the forward bias on T438, reducing its effective series resistance; the voltage across the motor therefore increases to counteract the original decrease. A rise in supply voltage or reduction in motor load will have the opposite effect to that described above.

### (b) Automatic recording level circuit

In the 'Record' position, R555 forms a resistive load for T433 and T434. Voltage developed across R555 is distributed as follows:

- (1) Via R559 to the recording level indicator circuit.
- (2) Via C745 to the recording level control circuit. During the negative half-cycles of voltage across R555, D435 conducts and charges C745 to the peak value of this voltage. During the positive half-cycles D434 conducts and charges C737 to the

peak value of this voltage, plus the voltage of the charge already present on C745. C737 is therefore charged to approximately the peak to peak voltage appearing across R555.

This positive voltage is fed to the base of T428, which becomes conductive, causing a current to flow through the base/emitter junction of T427, effecting a change of impedance between T427 collector and emitter.

The degree of attenuation of signals passing from T426 to T429 depends upon the potential divider consisting of, in its upper limb R537, and in its lower limb the collector/emitter impedance of T427.

Thus a means is provided for preventing signals fed from R555 via R558 to head K1 exceeding a pre-determined level.

Should a high level signal be followed by a low level signal, C737 discharges through R545 to a value proportional to the new low level signal. Switching the recorder to 'Stop' causes any charge on C737 to be rapidly discharged through R549, hence each time recording is commenced, the recorder is at maximum sensitivity.

## J—ELECTRICAL CHECKS AND ADJUSTMENTS

### 1. Record/playback head (K1) Azimuth adjustment

Remove snap-in head cover 108 by lifting firmly at its front edge (see Fig. 11), and place a test cassette with a 6300Hz tone (code number 8945 600 13501) into the recorder. Connect a suitable a.c. millivoltmeter to pins 2 and 3 of Socket 1. Using a known good set of batteries, switch to 'Playback' and adjust screw 'S' (see Fig. 12) for maximum voltage output. Seal screw 'S' with locking paint.

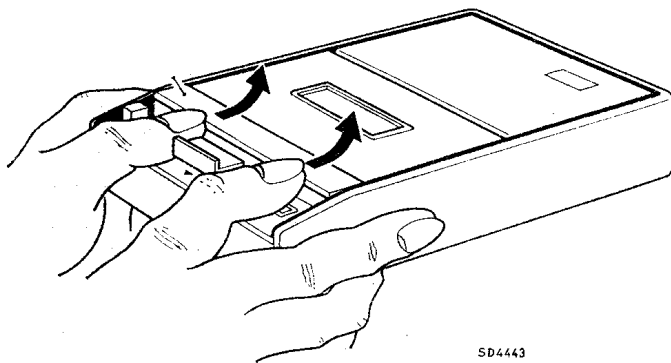


Fig. 11

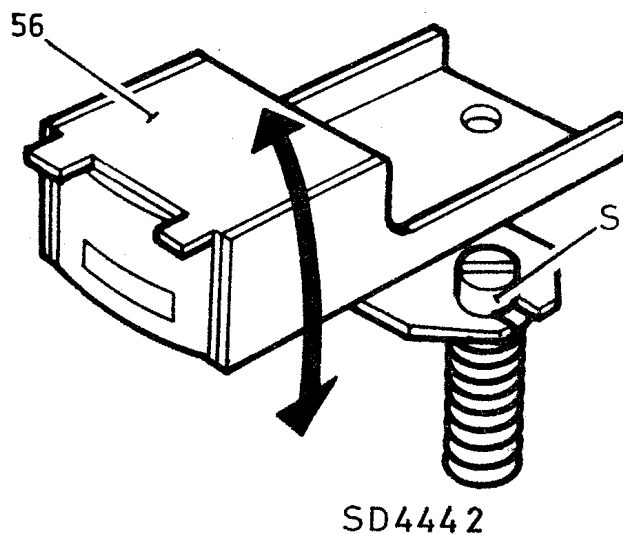
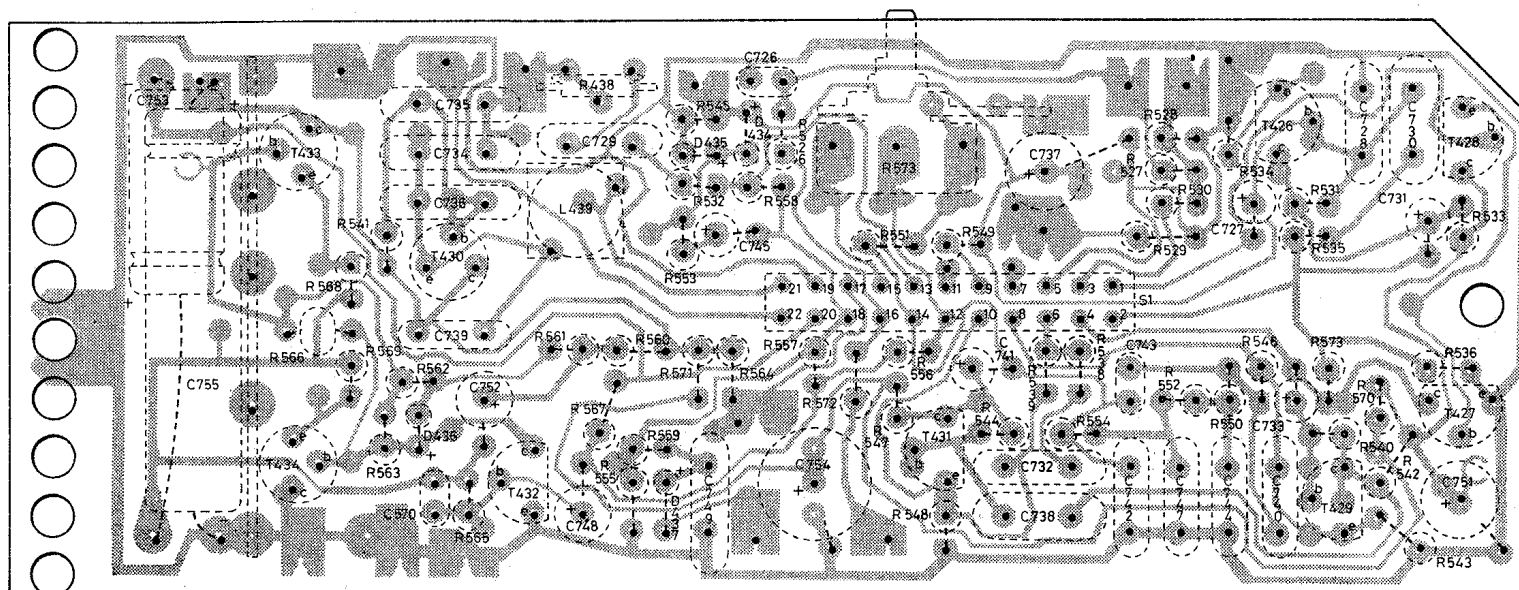


Fig. 12

C	753.	755.	735. 734.	729.	745.	726.	737.	743.	727.	730.		C
R			570. 736. 739.	748.	749.	754.	741.	732. 738.	742. 747.	744. 740.	731. 751.	R
MISC	T433.	T430.	T432.	L439.	D435.	D434.	T431.	S1.	T426.	T429.	T428. T438	MISC.
	T434.	D436.			D437.						D442. T427. T437.	



PLAYBACK POSITION VOLTAGES			
	Collector	Base	Emitter
T426	1-6	0-6	0-02
T427	0-1	0	0
T428	5-9	0	0
T429	1-6	0-5	0
T430	7-5	5-9	7-5
T431	3-4	0-9	0-3
T432	4-1	0-7	0
T433	7-5	4-3	—
T434	0	4-1	—
T437	7-3 *	2-5 *	2-4 *
T438	4-2 *	7-3 *	7-5

RECORDING POSITION VOLTAGES			
	Collector	Base	Emitter
T426	1-6	0-6	0-02
T427	0-05 †	0-5 †	0
T428	5-9	1-0 †	0-5 †
T429	2-1	0-9	0-6
T430	7-5	0-85	1-1
T431	3-2	0-6	0
T432	4-1	0-7	0
T433	7-5	4-3	—
T434	0	4-1	—
T437	7-3 *	2-5 *	2-4 *
T438	4-2 *	7-3 *	7-5

Voltages \* typical marginal variations depending on setting of R580  
Voltages † dependent on level of recording input signals  
All voltages taken with respect to chassis (negative) using a 20k $\Omega$  /volt meter

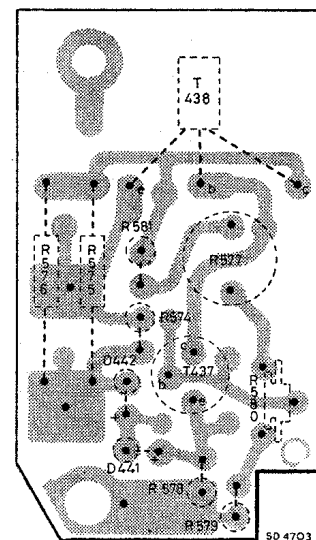


Fig. 13 Printed Panel—Print View

## 2. Adjustment of R438 (recording bias)

The amplitude of the recording bias current should be such that the specified frequency response (see Section B), consistent with minimum distortion is obtained. A low bias will result in distortion at high modulation levels, and a high bias will attenuate the treble frequencies excessively.

This current is checked by measuring the voltage drop across R529, which should be approximately 25mV a.c.

Switch to 'Record', connect an a.c. millivoltmeter between pins 6 and 2 (earth) of Socket 2, then adjust R438 to obtain the correct voltage. Small deviations from this voltage are permissible to satisfy the requirements stated above. The voltage across erase head K2 should be approximately 14V a.c., at a frequency between the limits 48–58kHz.

## 3. Checking Playback sensitivity

Remove the loudspeaker leads from the loudspeaker, and terminate them with an  $8\Omega$  1 watt resistor. Switch to 'playback' and turn the volume control to maximum.

A generator signal of 65–100mV at a frequency of 1kHz, applied via a 22k $\Omega$  resistor to pin 6 of Socket 2, should be required to produce an output of 630mV across the  $8\Omega$  resistor.

The voltage on pin 3, Socket 1 (line output) should be within the limits 65–100mV.

## 4. Checking automatic recording level control circuit

Prevent the oscillator from functioning by fitting a suitable wire link between the base and emitter of T430. Connect a suitable a.c. millivoltmeter between pins 6 and 2 Socket 2, and switch to 'Record'. A generator output of 1kHz at an amplitude of approximately 80mV, applied to pin 1 Socket 1 should be required for a meter indication of 4mV. Should this be the case, an increase of X10 in generator output voltage should be required to increase the meter indication to approximately 4.5mV.

Reduce the generator output voltage to its previous level, which should cause the meter indicator to fall rapidly to 1.8mV, followed by a progressive rise to 2.8mV over a period of 15 seconds.

## Note:

Pin 6 Socket 1 (Test point 1), connected to the base of T428, is used for checks only during manufacture.

## 5. Current and Resistance checks

### (a) Approximate total battery current (recorder operating less cassette)

Record	90mA
Playback	68mA
Forward wind and Rewind	110mA

### (b) Resistance of coils

Record/playback Head K1	(a-b)	36 $\Omega$
	(a-c)	30 $\Omega$
Erase Head K2		1 $\Omega$
Coil L439		46 $\Omega$

## K—MICROPHONE AND REMOTE CONTROL SWITCH

The N8210 is an omni-directional moving coil microphone incorporating a remote control switch as an integral part. When the remote control switch plug is inserted into Socket 2, switch S2 is opened, and the switch contained in the microphone case assumes an overall On/Off function, thus providing a remote start-stop control facility.

N8210 microphones are sealed during manufacture, and cannot be dismantled without sustaining damage. Spare parts for these microphones are not stocked. Details of capsule and switch connections to the microphone plugs are shown in Fig. 14 to provide information for checking the microphone as necessary.

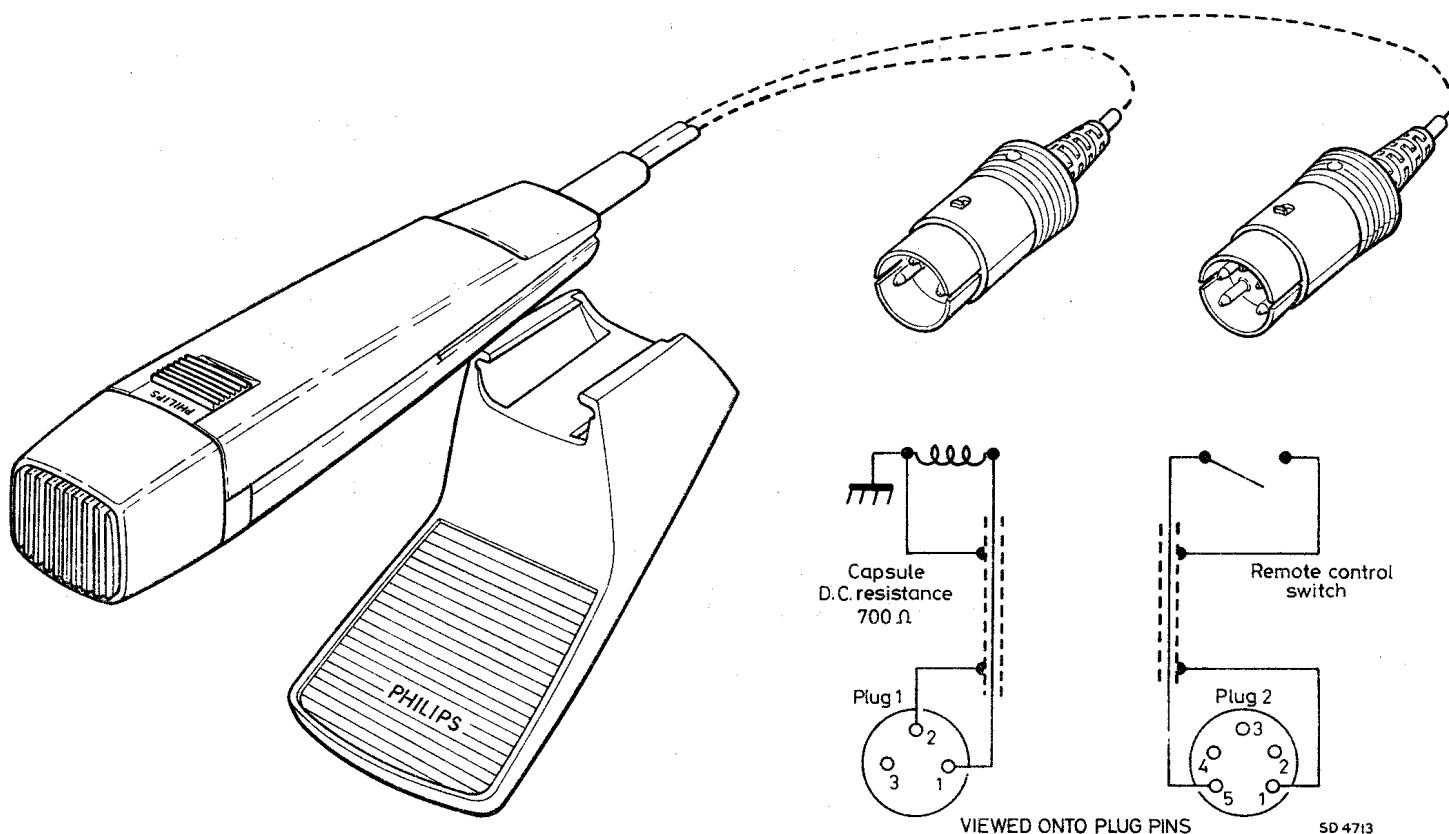


Fig. 14 Microphone Plug Connections