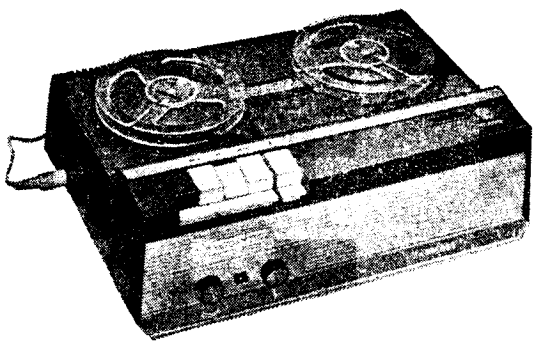
TAPE RECORDER

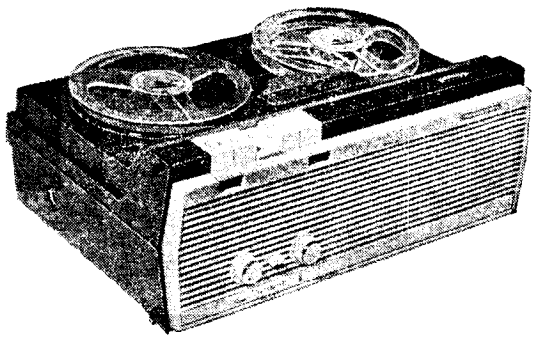
SERVICE INFORMATION FOR THE

PHILIPS
EL3552A/15A

AES
AMALGAMATED ELECTRIC SERVICES LIMITED

Stella
ST461





ISSUED BY:—

AMALGAMATED ELECTRIC SERVICES LTD.

WADDON FACTORY ESTATE CROYDON SURREY

Telephone: (see back of cover) Telex No. 262308

APRIL, 1966 PRICE 3s. 6d. AES 478

(Please quote AES 478 when ordering further copies)

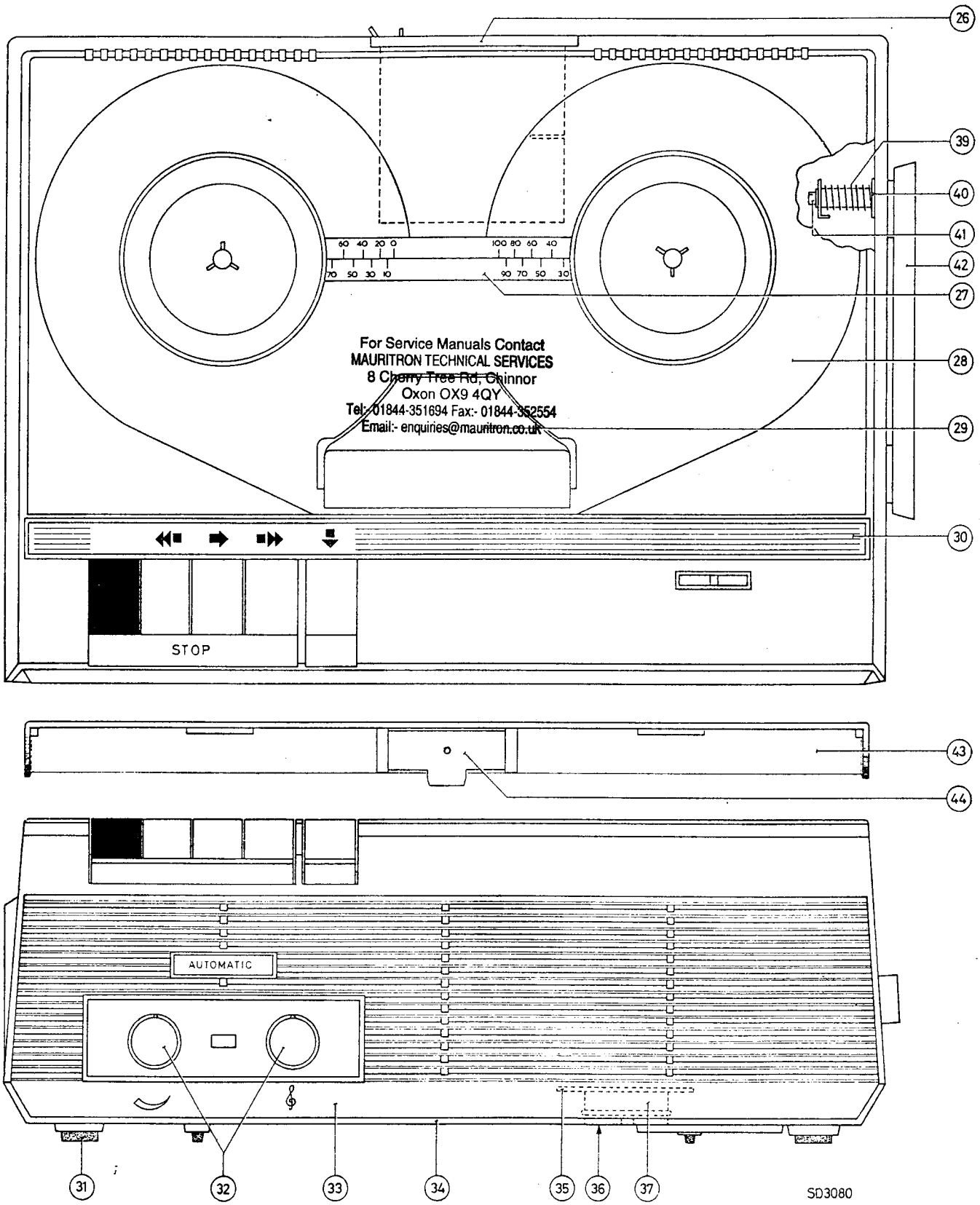


Fig. 1 Cabinet views — EL3552A/15A

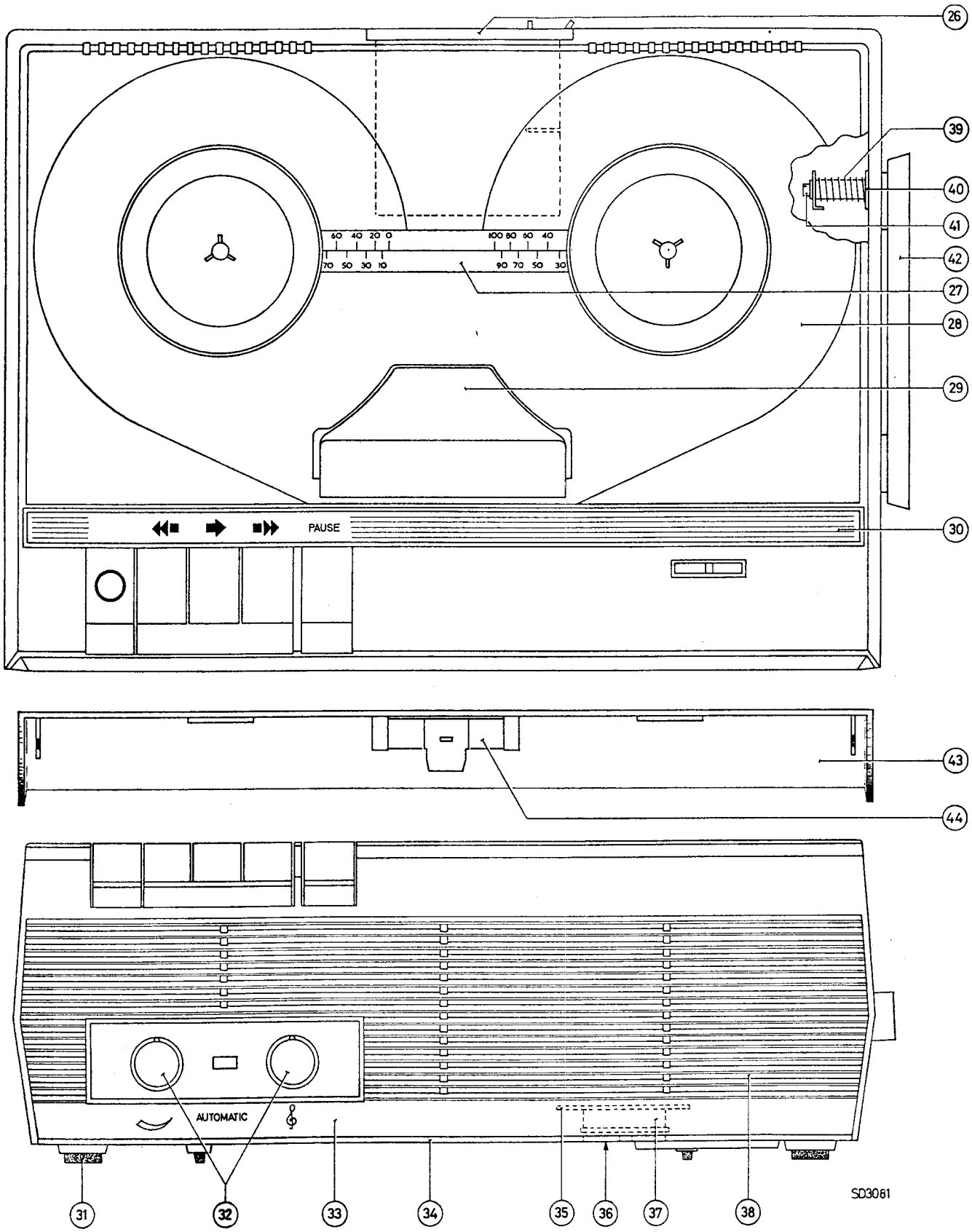


Fig. 2 Cabinet views — ST461

CONTENTS

PHILIPS	STELLA
EL3552A/15A	ST461

A — INTRODUCTION

This service information covers the two above models which are similar internally and differ mainly in presentation. The chassis comprises a two-track, single-speed, A.C. mains operated tape recorder, together with a printed circuit amplifier employing three valves and a transistor input stage. A circuit feature is 'Automatic Recording Control' which may be switched out for manual operation if required. Both models are fitted with a ribbon type modulation level indicator and in the EL3552A/15A model only, a window above the front control knobs, provides a visual reminder of the two recording modes.

Supplied with each recorder is a moving-coil type microphone, a 5″ reel of L.P. tape, an empty 5″ spool and a connecting lead. For details of additional Accessories available, see below.

B — SPECIFICATION

Recording sense	Left to right, 2-track
Tape speed	3¾ i.p.s.
Max. reel diameter	5¾″
Max. playing time (5¾″ D.P. tape)	2×90 mins. approx.
Forward wind/Rewind time	Approx. 3 mins. for 1,200 ft. of tape
Frequency range	80-12,000 c.p.s. within 6dB
Signal to noise ratio	Better than 40dB
Wow and flutter	Less than 0.6% peak to peak
Valves and semi-conductors	T1 AC107 V1 ECC83 V2 EF83 V3 EM87 V4 EL95 X1 BA100 or OA202 X2 OA79 MR1 SR250B75
Output power	1.5 watts
Loudspeaker	4″ dia. (5ΩZ)
Supply ranges	110, 127 and 200-250V A.C. 50 c.p.s. (adaptable for 60 c.p.s.)
Consumption	40 watts approx.
Input (pins 1/4 & 2)	Microphone (direct) 0.2mV into 2KΩ Radio or P.U. (via EL3768/03 connecting lead) 225mV into 1.5MΩ
Output (pins 3/5 & 2)	Ext. amplifier 750mV from 20KΩ
Weight	13 lbs. approx.
Dimensions	EL3552A/15A—14½″×10″×5″ ST461— 15″×10½″×5″
Tropicalized	

C — ACCESSORIES

Microphone connection box/extension lead ..	EL3962/02
Slide synchroniser	EL3769/00
Connection lead (Diode)	EL3768/04
Tape splicing kit	EL1901/50

Retailers should order the above and other Accessories from their usual wholesalers or in case of difficulty, consult the General Sales Division of:—

PHILIPS ELECTRICAL LTD.,

(Southern)	(Midlands & Northern)	(Scotland)
P.O. Box 130,	Wellingborough Road,	Well Hall Road,
17 Beddington Farm Road, Croydon, Surrey.	Sywell, Northants.	Hamilton, Lanarkshire.
Tel. MUNicipal 3377	Tel. Molton 3611	Tel. Hamilton 21122

WARNING

Do not switch off or disconnect the mains supply at some remote point to the recorder and leave the Play or Fast wind keys depressed. This practice will result in "flats" forming on drive surfaces and subsequently, mechanical noise.

D — UNCASING

Chassis

Detach the lid and invert the recorder then, using a long-bladed screwdriver, remove the four corner screws inside the base moulding. Holding the two cabinet sections together, turn recorder the right way up and carefully lift the top moulding away which will expose the chassis upperside. For access to the underside, detach the EM87 holder and raise the chassis from the four corner pillars. Before returning the chassis to the cabinet base, first ensure that all keys are UP and that record strip 56 is in a position to engage the front edge of switch actuator 202.

Amplifier

Raise the chassis as described above and pull-off the two front control knobs. Remove the two panel securing screws; one is adjacent to the speaker transformer and the other is near the EF83 valve. Release the panel by sliding it backward to clear the cabinet wedges.

E — MECHANICAL DESCRIPTION

1. Drive mechanism

Drive from the dual standard (50 & 60c/s) motor pulley/fan assembly 127 is transmitted to the flywheel and fast wind pulleys by the main drive belt 107. A second drive belt 119 couples the uppermost groove in the motor pulley to drive wheel 120 which, together with R.H. friction disc 52, provides a slipping drive to the R.H. turntable for take-up purposes.

2. Playback

When the Play key is depressed, play strip 72 moves backward and pivots coupling assembly 104 which actuates pressure arm 102. This allows pressure roller 122 to engage the capstan and brings pressure plate 101 towards K1. At the same time, play strip 72 pushes brake arm 60a away from the L.H. turntable which in turn, pivots drive/brake bracket 75, thereby releasing the R.H. turntable. In addition, the play strip also operates SK4 via lever 411 and places this switch in the 'play' position.

To maintain tape tension during transport, a slight braking action is applied to the tape by the friction between felt washer 51 on the L.H. turntable underside and the L.H. friction disc 52. Accidental erasure of the tape during playback is avoided by the position of lever 411 which interlocks with a tongue on record strip 56 and prevents depression of the Record key.

Depressing Stop bar 63 releases the Play key allowing spring 103 to pull the pressure arm away from the capstan, the play strip and SK4 to return to their rest positions, also the brake assemblies to be applied to the turntables.

3. Recording

To record, the Record key (red or circled) is fully depressed first and held in this position whilst the Play key is also depressed until both keys lock down. Operation of the Record key actuates via control strip 56, the record/playback switch SK1 and places this switch in the 'record' position. The action of the Play key is identical to that described for Playback above.

4. Pause control

The Pause key provides a rapid stop (or start) facility during recording or playback and, when operated, is locked down by lock/release bar 64. Depressing the key moves pause strip 78 backward which interlocks with wind actuator 74 and brake block 77 attached to this strip, stops the L.H. turntable. At the same time, a vertical tongue on the pause strip pivots pause lever 412 sufficiently to move the pressure roller bracket away from the capstan.

When the Pause key is released by depressing bar 64, spring 80 on the pause lever, returns the pause strip to rest and allows the pressure roller to engage the capstan.

5. Forward wind

Depressing the Forward wind key moves strip 79a which pivots control bracket 73 and, via wind actuator 74, slides drive/brake bracket 75 to the right. This action releases both turntable brakes and engages forward wind pulley 94a with the R.H. turntable. Tape tension is provided by the friction between felt washer 51 on the L.H. turntable underside the L.H. friction disc 52. During forward winding, the position of wind actuator 74 prevents the Pause key from being operated. When the Forward wind key is released by depressing Stop bar 63, the tension of springs 86 and 76 return the forward wind mechanism to rest.

6. Rewind

Depressing the Rewind key moves strip 79b which pivots control bracket 73 and, via wind actuator 74, slides drive/brake bracket 75 to the right. This action releases both turntable brakes and engages rewind pulley 94b with the L.H. turntable. Tape tension is provided by the friction between felt washer 51 on the R.H. turntable underside and R.H. friction disc 52. During rewind, the position of wind actuator 74 prevents the Pause key from being operated.

When the Rewind key is released by depressing Stop bar 63, the tension springs 86 and 76 return the rewind mechanism to rest.

F—REPLACEMENT OF MAJOR COMPONENTS

1. R.H. turntable 50, and friction assembly 52–54–120

Detach the retaining circlip and washer(s) from the turntable spindle below the chassis then raise the turntable sufficiently to release drive belt 119 from the motor pulley. The R.H. turntable and friction assemblies may now be withdrawn complete, taking care not to misplace the special washers associated with these assemblies. If the four friction blocks 54 on R.H. friction disc 52 are removed or replaced, they must be refitted correctly as shown in Fig. 3.

Re-assemble in the reverse order and check the turntable play on the vertical spindle which should be 0.1-0.3mm. Add or remove washers between the spindle circlip and the bearing underside to achieve this.

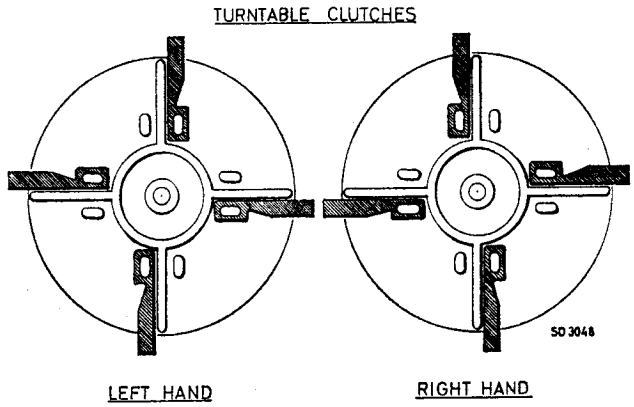


Fig. 3

2. L.H. turntable 50, and friction assembly 52-54-55

Detach the retaining circlip and washer(s) from the turntable spindle below the chassis then withdraw the L.H. turntable and friction assemblies complete. When dismantling, care should be taken not to misplace the special washers associated with these assemblies. If the four friction blocks 54 on L.H. friction disc 52 are removed or replaced, they must be refitted correctly as shown in Fig. 3.

Re-assemble in the reverse order ensuring that the peg on friction wheel 55 locates in the chassis tongue provided.

Check also the turntable vertical play as described for the R.H. turntable in 1 above.

3. Flywheel 67 and Main drive belt 107

Remove the R.H. turntable and friction assemblies, see 1 above, then release the main drive belt from the motor pulley. Slide off dust excluding washer 110 from the capstan, detach spring 80 and remove the three screws 23 which secure upper bearing plate 116. Finally, release the lower mounting bracket 405 (two screws) and carefully remove the capstan. Upper bearing plate 116 may now be raised so that the drive belt can be withdrawn completely. Re-assemble in the reverse order ensuring that all driving surfaces are clean and that the flywheel spins freely without binding.

4. Control keys 60-61-130

Detach spring 62 from the key to be removed, then slide back the respective control strip, i.e., 56-72-78-79a or 79b. Holding the control strip in this position, lift out key. For the two fast wind keys, this operation is made easier if spring 86 is removed first.

5. Pause lock/release bar 64 and Stop bar 63

Detach springs 80, 86 and 103. Remove the L.H. turntable and friction assemblies, see section 2 above, also all control keys as described in section 4. Open slightly the forked rear ends of control strips 79a and 79b, then slide out the vertical tongues of control bracket 73. Slide pause strip 78 forward to release same from the chassis slots which will allow lock/release bar 64 to be removed when turned through 90°. Stop bar 63 may now be detached by sliding it to the right before withdrawing.

6. Drive and R.H. brake bracket 75

Remove the L.H. turntable and friction assemblies, see 2 above, then release main drive belt 107 from the fast wind pulleys. Detach springs 76 and 86. Release spring strip 87 and plate 406 (held by circlip), ensuring that the ball bearings 96 are not misplaced. Remove circlip 5 from the L.H. turntable spindle bearing and lift play strip 72 so that circlip 5a may also be detached. Raise wind actuator 74 sufficiently to remove drive and R.H. brake bracket 75, taking care not to misplace the ballbearings associated with this item. Re-assemble in the reverse order.

7. K1 head cover

The protective cover over the record/play-back head K1 can be removed by pressing down plate D with a screw-driver, see Fig. 4, and pulling the cover backwards.

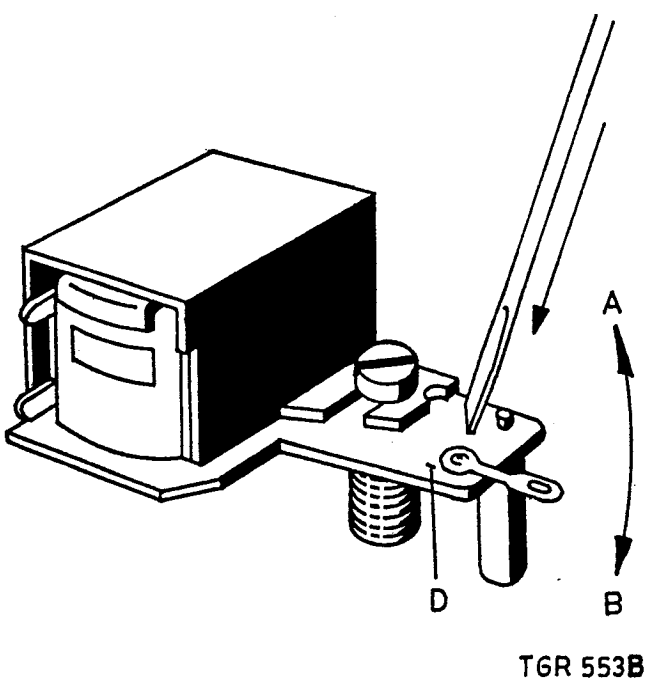


Fig. 4 K1 screen removal

8. Erase head K2

The erase head may be removed from holder 108 by prising out with a screwdriver, see Fig. 5.

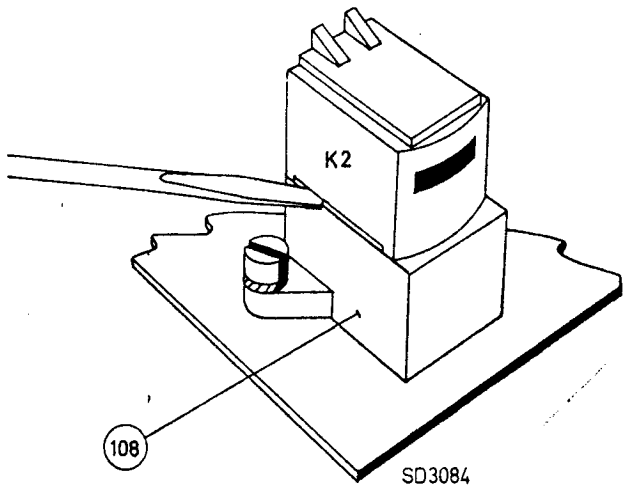


Fig. 5 Erase head removal

G—MECHANICAL CHECKS & ADJUSTMENTS

1. Pressure plate assembly 101

The record/playback head pressure pad is vertically self-aligning and with the Play key depressed, should offer a pressure of 15-25 grams measured at the point shown in Fig. 6. Adjustment can be made by bending the tongue on the pressure plate to which the spring is anchored, or if necessary by replacement of this spring.

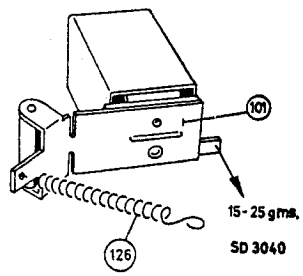


Fig. 6

2. Pressure roller assembly 122-124

With the Play key depressed, spring 125 should exert a pressure roller force of 350± 40 grams on the capstan measured as shown in Fig. 7. Adjust or replace spring 125 to achieve this. In addition there should be a clearance of at least 1mm. between pressure roller bracket 124 and pressure arm 102 at point L as given in Fig. 7. Adjustment may be made by bending the pressure roller bracket at point M.

3. Pause strip 78

With the Play and Pause keys depressed, a clearance of 0.5-1mm. should exist between the pressure roller and the capstan. Adjust when necessary by bending the vertical tongue P on pause strip 78 as shown in Fig. 7.

With the Pause key at rest, spring 80 should force pause lever 412 against the vertical tongue P of pause strip 78 with a tension of at least 100 grams. If necessary adjust or replace spring 80.

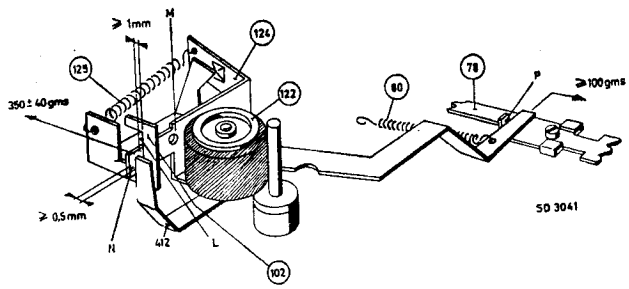


Fig. 7

4. Coupling assembly 104

With the Play key depressed and the coupling assembly held against its stop (as indicated by R.H. arrow (Q) in Fig. 8), there should be a clearance of at least 1mm. between the end of this coupling assembly R and the vertical tongue on play strip 72 as shown in Fig. 8.

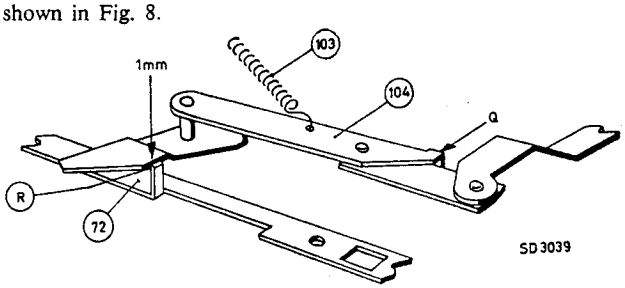


Fig. 8

With all keys in the rest position, spring 103 should apply a tension of 20 grams measured on coupling assembly 104 as given in Fig. 9. Adjust or replace spring 103 as necessary.

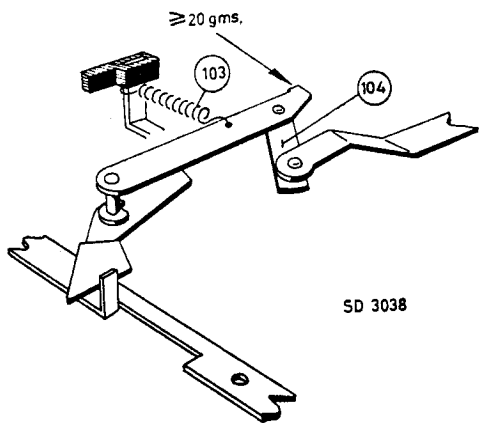


Fig. 9

5. Fast wind pulleys 94a and 94b

In the Rewind and Forward wind positions, drive pulleys 94a and 94b should engage 0.1-0.5mm. above the rim bottom edge of their respective turntables. Add or remove washers 93 to obtain correct height.

6. Forward wind

With the Forward wind key depressed, the force required to overcome the L.H. turntable friction should lie between 15 and 25 grams measured as shown in Fig. 10.

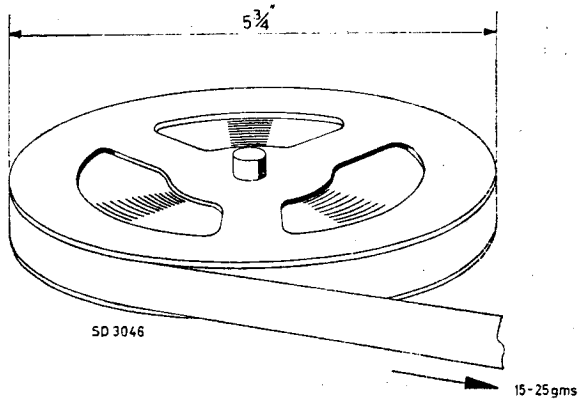


Fig. 10

7. Rewind

With the Rewind key depressed, the force required to overcome the R.H. turntable friction should lie between 15 and 25 grams measured as shown in Fig. 11.

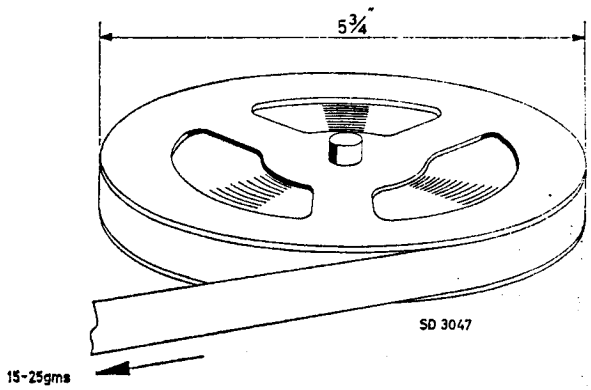


Fig. 11

8. Brake bracket 75

In the rest position (all keys up), and the R.H. turntable held stationary by brake ring 59a, the L.H. brake ring should clear the L.H. turntable by 0.2 to 0.5mm. This may be adjusted by bending point T of drive and R.H. brake bracket 75 as shown in Fig. 12.

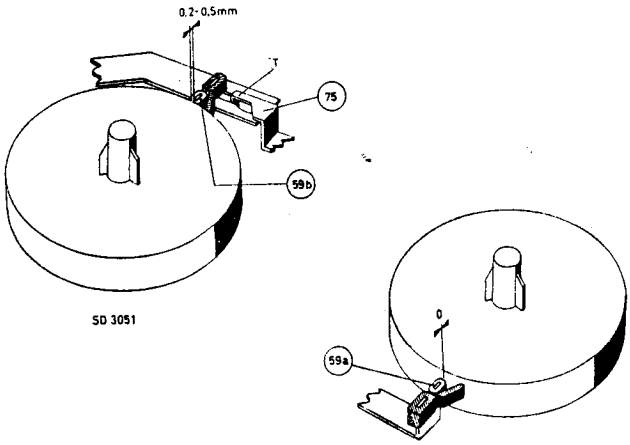


Fig. 12

9. L.H. tape guide 95

The height of the L.H. tape guide should be adjusted so that the tape top edge is positioned 0-0.2mm. below the core of the erase head.

10. R.H. tape guide 113

The height of the R.H. tape guide should be adjusted so that the tape passes smoothly from the pressure pad to this guide without wrinkling.

11. Motor pulley 128

The height of motor pulley 128 should be adjusted so that with the motor in the normal mounted position, the rim between the 50 c/s and 60 c/s belt grooves is level with the groove centres in the fast wind pulleys and the flywheel.

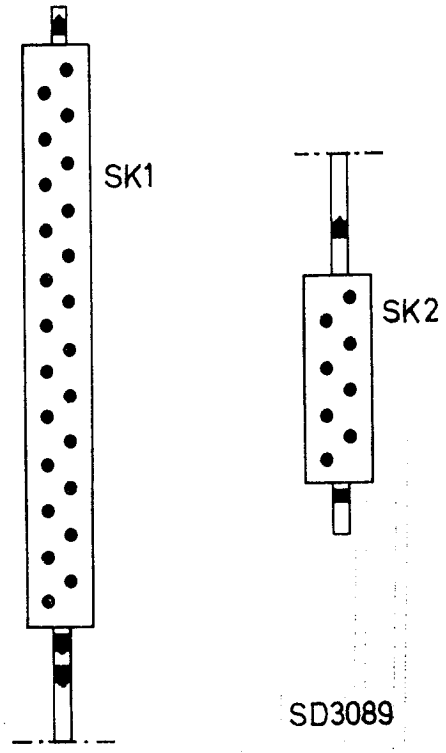


Fig. 13

12. Adjustment of switches SK1 and SK2

In the manual record position, switches SK1 and SK2 should be positioned as shown in Fig. 13. Adjustment can be made by bending the part of record strip 56 which is situated under the mounting plate.

H—CONVERSION FROM 50 TO 60 c/s (OR 60 TO 50 c/s)

50 to 60c/s

Uncase the recorder then, using a pair of long-nosed pliers or tweezers, transfer drive belt 107 from groove A to groove B as shown in Fig. 14.

60 to 50c/s

Follow the directions given for 50 to 60c/s, except that drive belt 107 is transferred from groove B to groove A.

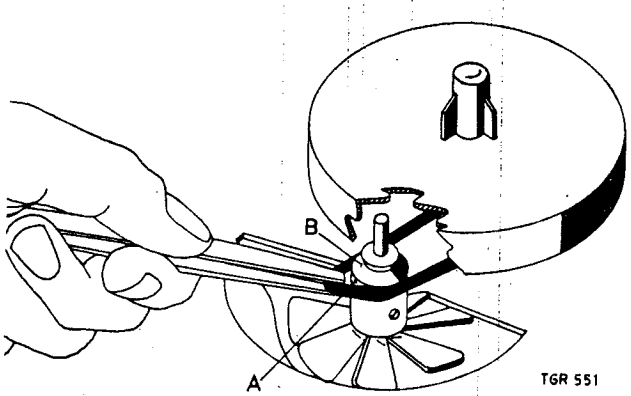


Fig. 14

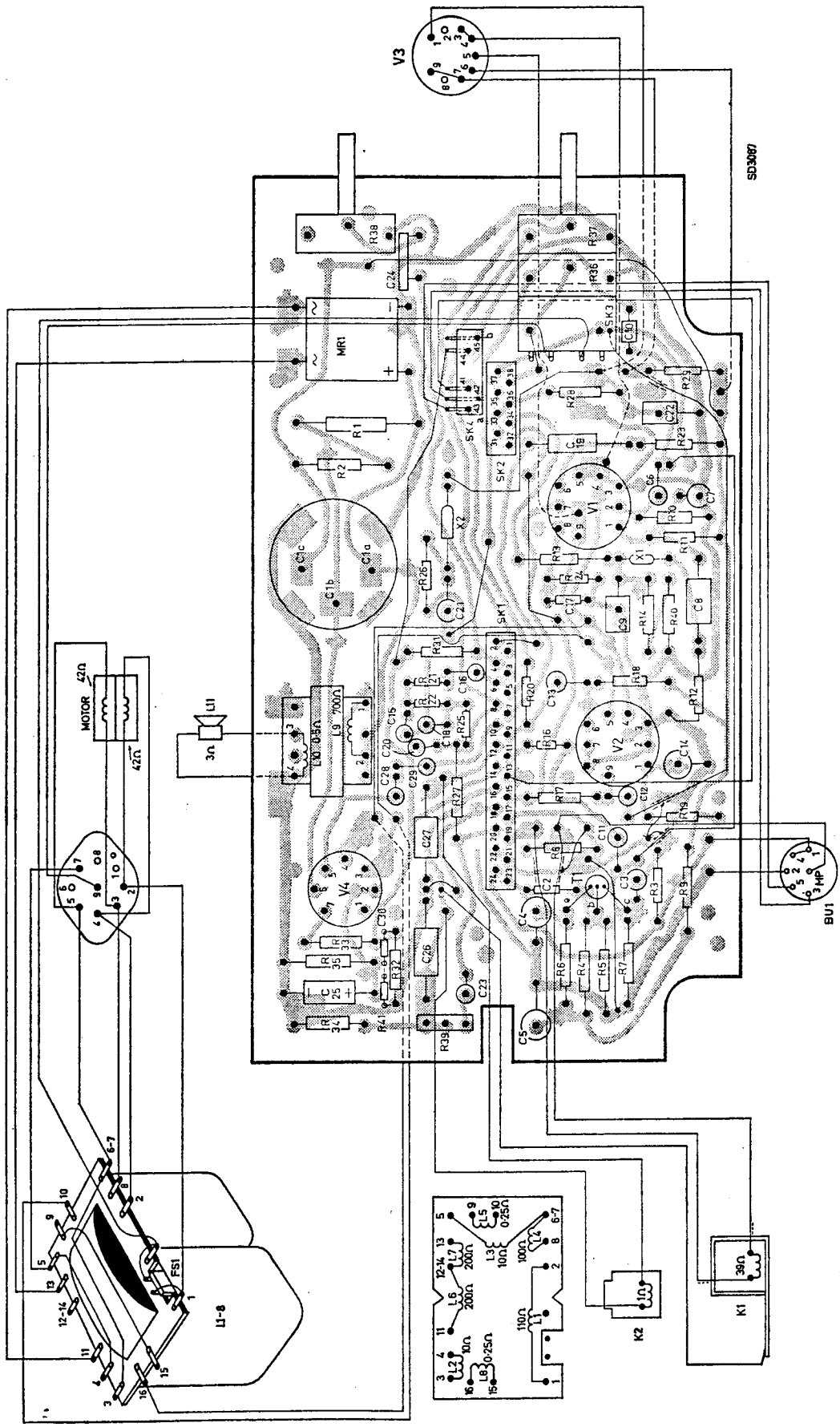


Fig. 15 PRINTED PANEL—component side

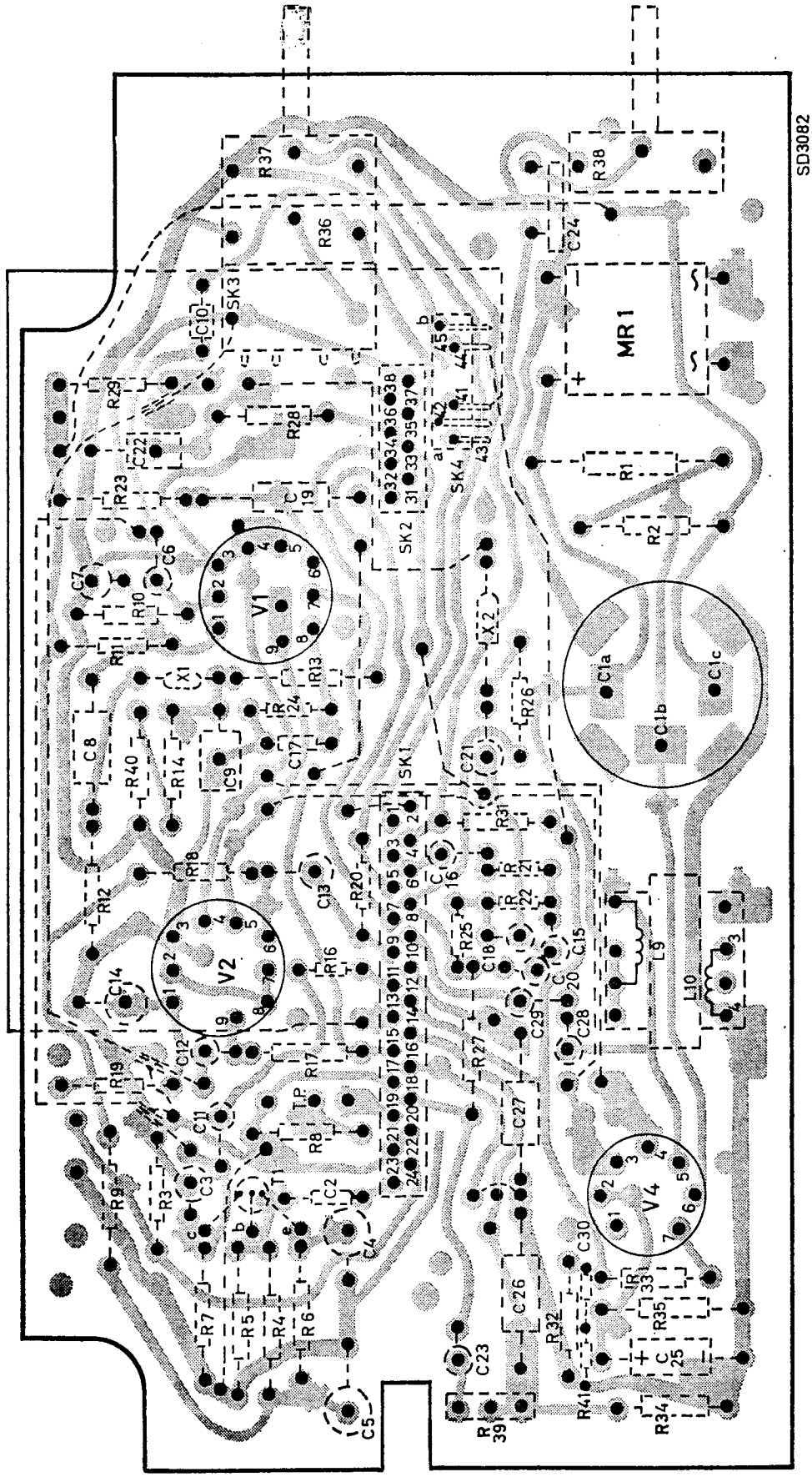


Fig. 16 PRINTED PANEL—print side

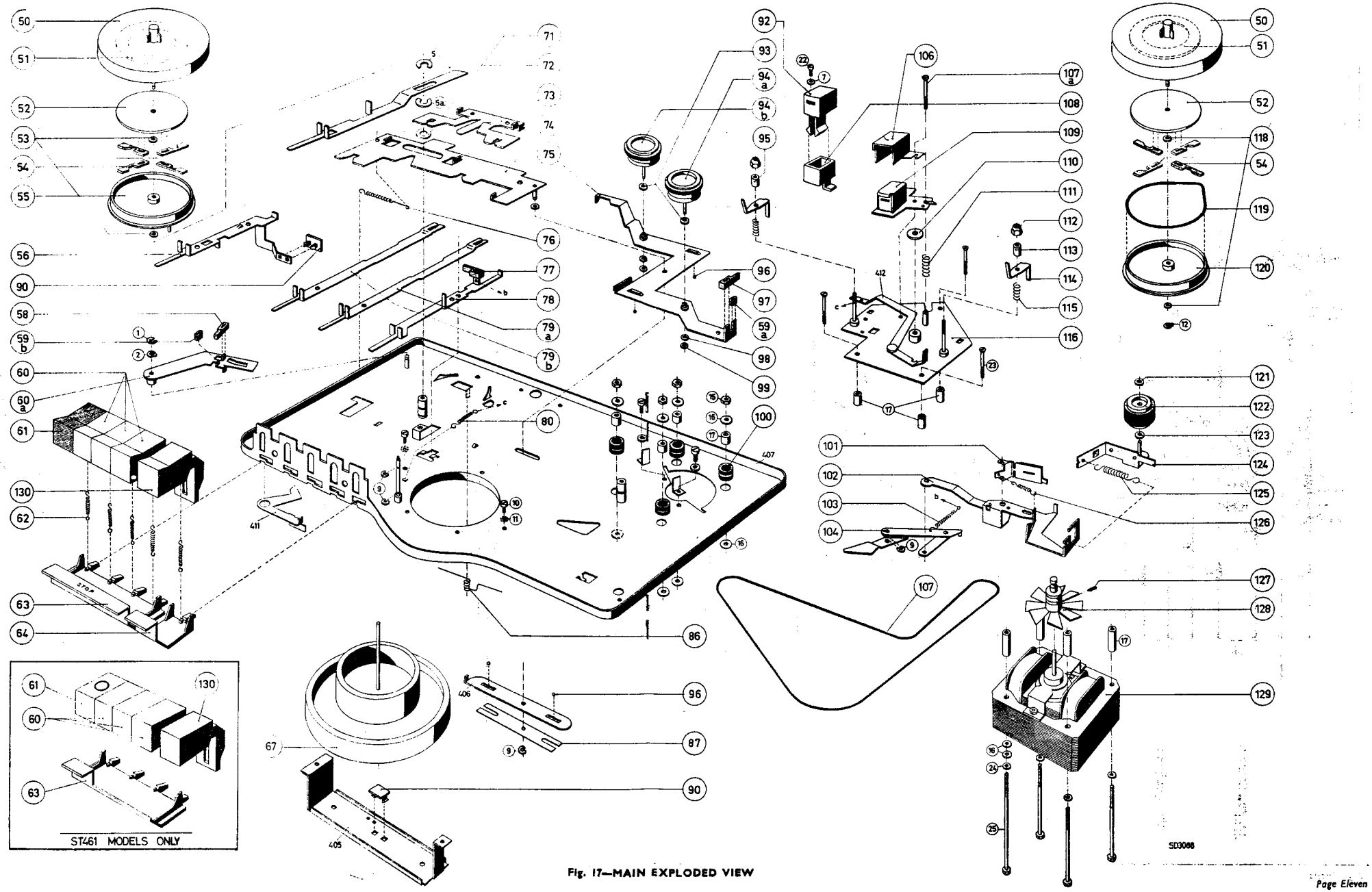


Fig. 17—MAIN EXPLODED VIEW

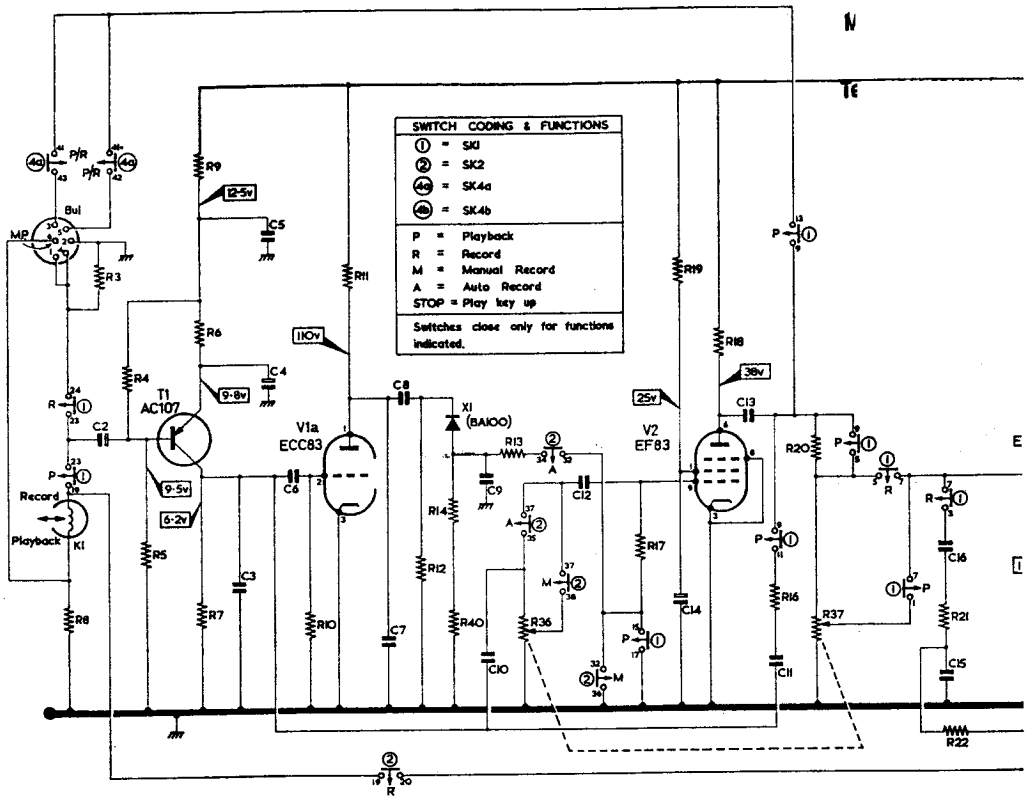
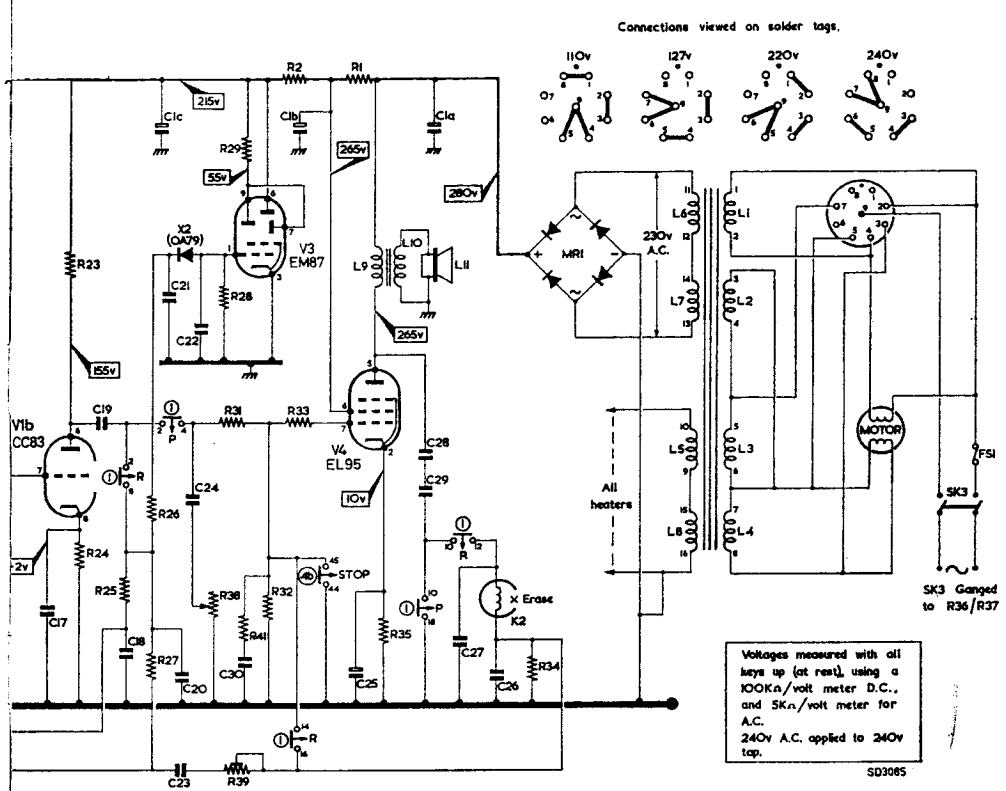


Fig. 18



MAIN CIRCUIT

RESISTORS Ω

R1	...	...	1K	R14	...	...	22M	R27	...	...	27K
R2	...	...	6.8K	R15	...	...	100K	R28	...	...	2.7M
R3	...	...	5.6K	R16	...	...	150K	R29	...	...	100K
R4	...	...	22K	R17	...	...	22M	R31	...	...	150K
R5	...	...	68K	R18	...	...	100K	R32	...	...	470K
R6	...	...	10K	R19	...	...	330K	R33	...	...	5.6K
R7	...	...	22K	R20	...	...	180K	R34	...	...	22K
R8	...	...	22	R21	...	...	150K	R35	...	...	330
R9	...	...	470K	R22	...	...	100K	R36/R37	...		200K+200K
R10	...	...	10M	R23	...	...	68K	R38	...		220K
R11	...	...	100K	R24	...	...	1.5K	R39	...		10K or 22K
R12	...	...	100K	R25	...	...	100K	R40	...	...	22M
R13	...	...	100	R26	...	...	150K	R41	...	...	56K

CAPACITORS pF

C1	...		50+32+32uF	C11	...	...	1K	C21	...	...	150
C2	...	...	2.5uF	C12	...	...	10K	C22	...	...	0.1uF
C3	...	...	470	C13	...	...	10K	C23	...	...	330
C4	...	...	32uF	C14	...	...	2uF	C24	...	...	4.7K
C5	...	...	50uF	C15	...	...	270	C25	...	...	40uF
C6	...	...	4.7K	C16	...	...	2.2K	C26	...	...	39K
C7	...	...	390	C17	...	...	47K	C27	...	...	56K
C8	...	...	33K	C18	...	...	270	C28	...	...	2.3K
C9	...	...	0.56uF	C19	...	...	33K	C29	...	...	3.3K
C10	...	...	47K	C20	...	...	560	C30	...	...	560

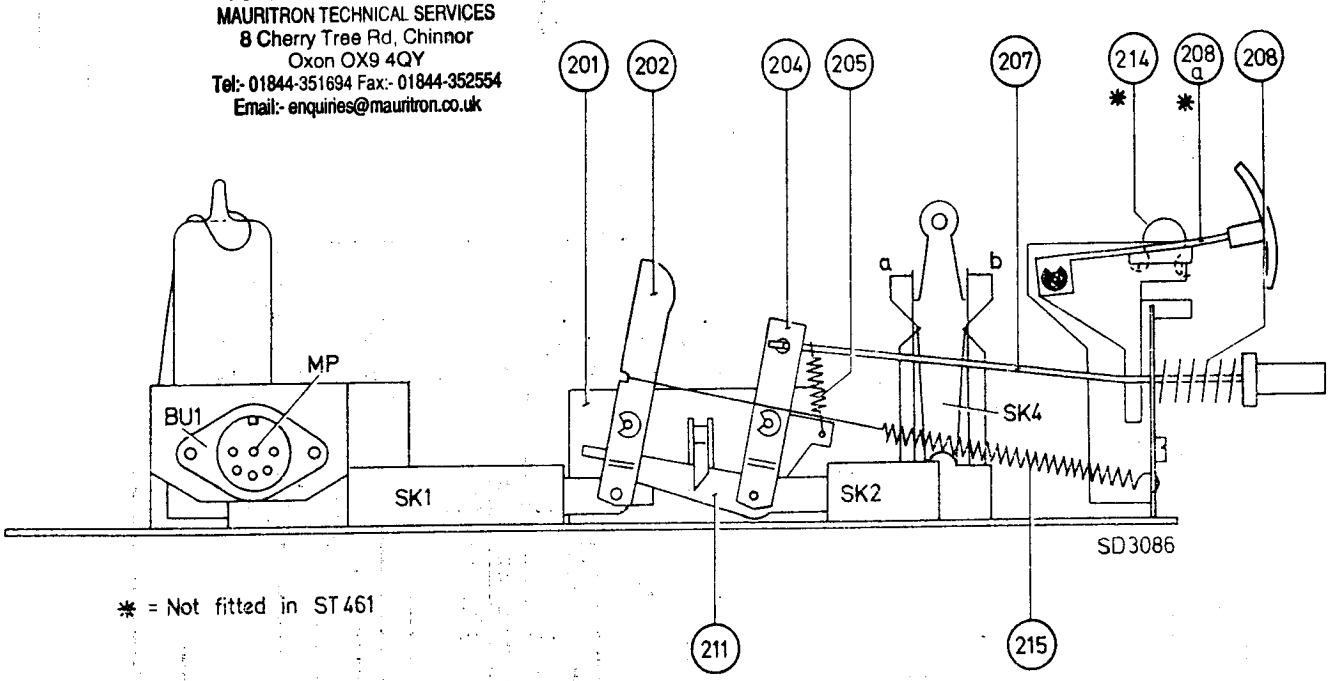


Fig. 19 Switches and operating mechanism

I—MAINTENANCE

Cleaning

1. Record/playback and erase heads, etc.

The magnetic head faces, tape guides, pressure roller and capstan should be cleaned at regular intervals if optimum performance is to be maintained. Clean with a soft cloth wrapped around a wooden stick and moistened with methylated spirits or industrial alcohol. Do not allow metal objects to come into contact with the magnetic head faces.

2. General

After approximately 500 hours of service, it is advisable to clean the following parts with industrial alcohol or methylated spirits:—

Magnetic head faces
Tape guides 95 and 113
Capstan and pressure roller contact surfaces
Drive belts 107 and 119
Fast wind pulleys 94a and 94b
Motor pulley 128
Flywheel belt groove
Friction disc 52
Undersides and braking surfaces of turntables 50
Brake blocks 58 and 97

Dust and clean pressure pad assembly 101 with a soft dry brush.

Lubrication

All recorders are fully lubricated during manufacture and further attention should only be required after a service period of 500 hours. If this is the case, or if any mechanical components are replaced, lubrication should be applied SPARINGLY to the positions given below. It is emphasised that excessive lubricant will hinder rather than help the instrument's operation, particularly so if grease or oil is deposited on the driving surfaces.

Using a light machine oil preferably containing graphite, lubricate the following positions:—

Spindle bearings for turntables and fast wind pulleys
Upper and lower flywheel bearings
Pressure roller bearing
Upper and lower motor bearings

Using a light molybdenum-disulphide based grease, lubricate all sliding surfaces of the various control strips and bracket hinges.

J—ELECRICAL CIRCUIT DESCRIPTION

Record

Input signals applied to Bu1 (pins 1-4) either from the microphone direct, or from radio/pick-up sources via the attenuator connecting lead EL3768/03, are coupled by C2 the base of T1, the pre-amplifier transistor.

AUTOMATIC (*Auto-manual button not depressed*)

T1 collector output is fed by C10 and C12 to g1 of the second signal path amplifier V2, which is a variable-mu type pentode. At the same time, the collector signals are also coupled via C6 to the control grid of V1a and after amplification, the output of this stage is fed by C8 to diode X1. X1 rectifies the audio signals and supplies a potential negative with respect to chassis across a load consisting of R14+R40. Since the rectifier load also forms part of the control grid circuit for V2, the gain of this valve is determined by the diode voltage which provides automatic recording control.

MANUAL (*Auto/manual button depressed*)

From T1 collector, signals are fed via C10 to the record level control R36 and then by C12 to V2 control grid.
C13 couples the output at V2 anode to the third amplifier (V1b) and a frequency selective N.F.B. network over this stage between C19 and the input, produces a rising treble characteristic required for recording purposes. The recording signals at C19 are fed by R27 to the record head K1 and by R26 to the rectifier X2 for display on the visual indicator, V3.

Recording bias and erase waveforms are generated in an H.F. oscillator composed of V4, the erase head K2 and the associated components. Bias current for the record head K1 is fed via C23 and the variable resistor R39.

Playback

Signals induced into the playback head K1 are coupled by C2 to the base of T1, the transistor pre-amplifier stage. Output at T1 collector is fed by C10 to a gain control R36 and then via C12 to the second amplifier control grid of V2. A frequency selective N.F.B. path over V2 consisting of C11/R16 provides the bass boost necessary for playback correction.

From V2 anode the fully equalised signals are fed via C13 to the Diode output connections at Bu1 (pins 3-5), and to a second gain control R37 (ganged to R36) in the control grid circuit of V1b. The output at V1b anode is coupled by C19 to the tone control C24/R28, and then via R31/33 to V4 control grid. In the 'Stop' position, i.e. Play key up, the junction R31/33 is shorted to chassis by SK4b which mutes V4 input for stand-by purposes.

K—ELECTRICAL CHECKS & ADJUSTMENTS

1. Record/playback head K1

The aximuth setting of K1 is adjusted by screw 107a, see Fig. 20. To obtain the correct head position, place a full or half-track width azimuth test recording of 8Kc/s at 3¾ i.p.s. on the recorder and connect an A.C. millivoltmeter (300mV range or as required), to tag 3 on Bu1. Play back the test tape and adjust screw 107a for maximum meter deflection. Screw 107a should be sealed with locking paint.

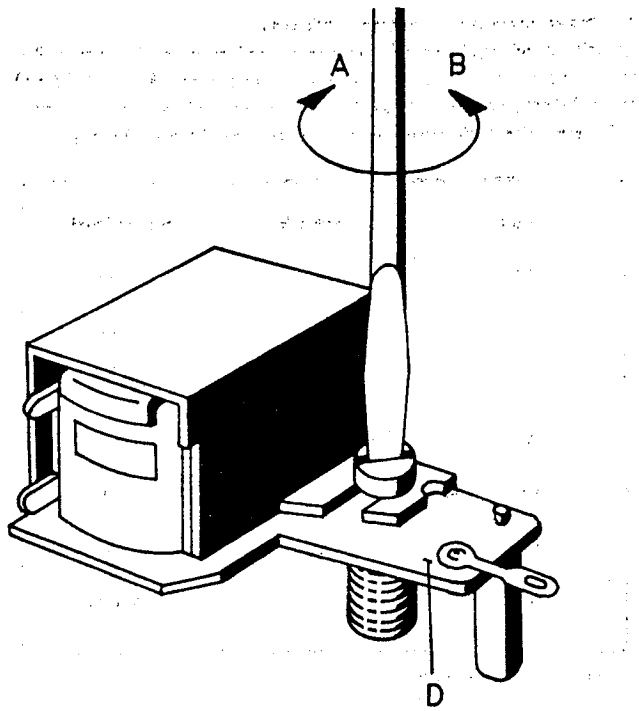


Fig. 20 Azimuth adjustment

2. Recording bias current adjustment

The recording bias current in K1 is determined by the setting of R39 and should normally lie within the limits of 0.9 and 2mA which may be measured as a voltage of 20 to 45mV at the measuring point (M.P.) on Bu1. To ascertain the correct setting, carry out the Overall frequency response check given below, checking whether or not the playback requirements for the test tones are met. Increasing the value of R39 will reduce the bias current and increase the treble response; conversely, decreasing the value of R39 will raise the bias current and produce the opposite effect. However, a bias current lower than the limit specified will cause distortion at high modulation levels, and a setting above the limit will result in poor treble response. If the frequency response test requirements cannot be met with a bias current inside the limits stated, a defect in the record head or the amplifier circuitry should be suspected.

3. Overall frequency response check

Switch to Manual record, set the record level control R36 to maximum and apply a generator source of 42mV to tag 1 or 4 on Bu1 via a 1.5mΩ resistor. Maintaining this input constant, record test tones of 1Kc/s and 10Kc/s. Connect an A.C. millivoltmeter to tag 3 on Bu1 and playback the recorded tones noting the voltage readings for both frequencies. The output at 1Kc/s should be 250mV approx. (Odb), and the difference at 10Kc/s should not exceed —6dB.

4. Stage sensitivity—'record' (Manual)

Switch to Manual record, set the modulation level control R36 to maximum and apply a generator source of 1Kc/s at 180mV via a 1.5MΩ resistor to tag 1 or 4 on Bu1. Using an A.C. millivoltmeter, the following signal voltages should now be read:

Stage	Electrode	Signal level
T1	b	0.3mV
T1	c	50mV
V2	g1	45mV
V2	a	4V
V1b	g1	0.57V
V1b	a	4.5V
M.P.	—	3.3mV*

* Bias oscillator stopped.

5. Record sensitivity—automatic

Depress the record key only and ensure that the Auto/manual button is OUT. Apply a generator source of 1Kc/s at 2V via a 1.5MΩ resistor to tag 1 or 4 on Bu1 and connect an A.C. millivoltmeter to the measuring point, M.P., which should read 4mV± 2dB. Quickly reduce generator level 20dB (10 times—to 200mV) and observe the meter which should indicate 2.75mV±2dB after a lapse of 45 to 60 seconds.

6. Stage sensitivity—'playback'

Switch to playback, turn volume control R36/37 to maximum and set tone control R38 to maximum treble. Replace the loudspeaker L11 with a 3Ω1W resistor and apply a generator source of 1Kc/s at 40mV via a 22KΩ resistor to the measuring point, M.P. Using an A.C. millivoltmeter, the following signal voltages should now be read:

Stage	Electrode	Signal level
T1	b	0.06mV
T1	c	1.2mV
V2	g1	1.1mV
V2	a	77.5mV
V1b	g1	71mV
V1b	a	1.3V
V4	g1	600mV
—	L10	390mV

7. Motor

If hum occurs after motor re-installation or replacement, the connectors in pairs should be inter-changed, i.e. 1 and 2 with 3 and 4, see Fig. 21. Alternatively, the motor may be detached and turned through 90° before remounting.

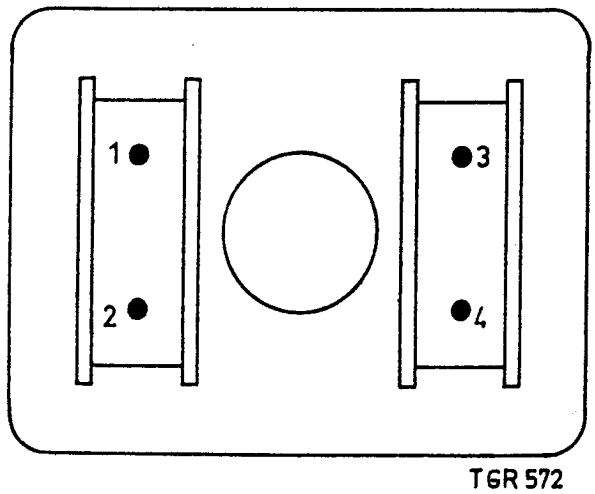


Fig. 21 Motor connections

Connecting lead

When using the Radio/P.U. input, it is essential that one or other of two connecting leads be used to avoid overloading the record input stage. The lead type EL3768/04 should be used whenever the input source employs a 5-pin DIN diode output socket. On all other occasions, the lead type EL3768/03, supplied with the recorder should be used. This lead incorporates a series resistor, 1.5MΩ, in the red conductor, but under certain conditions depending on the amplitude of the input signal, the value of this resistor may be altered to obtain satisfactory recordings.

The connections of this lead are: Red—recording input: White—line output; Black—common earth (screening), see Fig. 22.

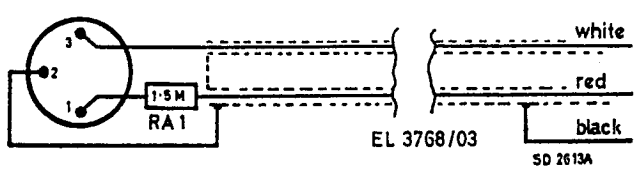


Fig. 22 P.U./Radio connecting lead

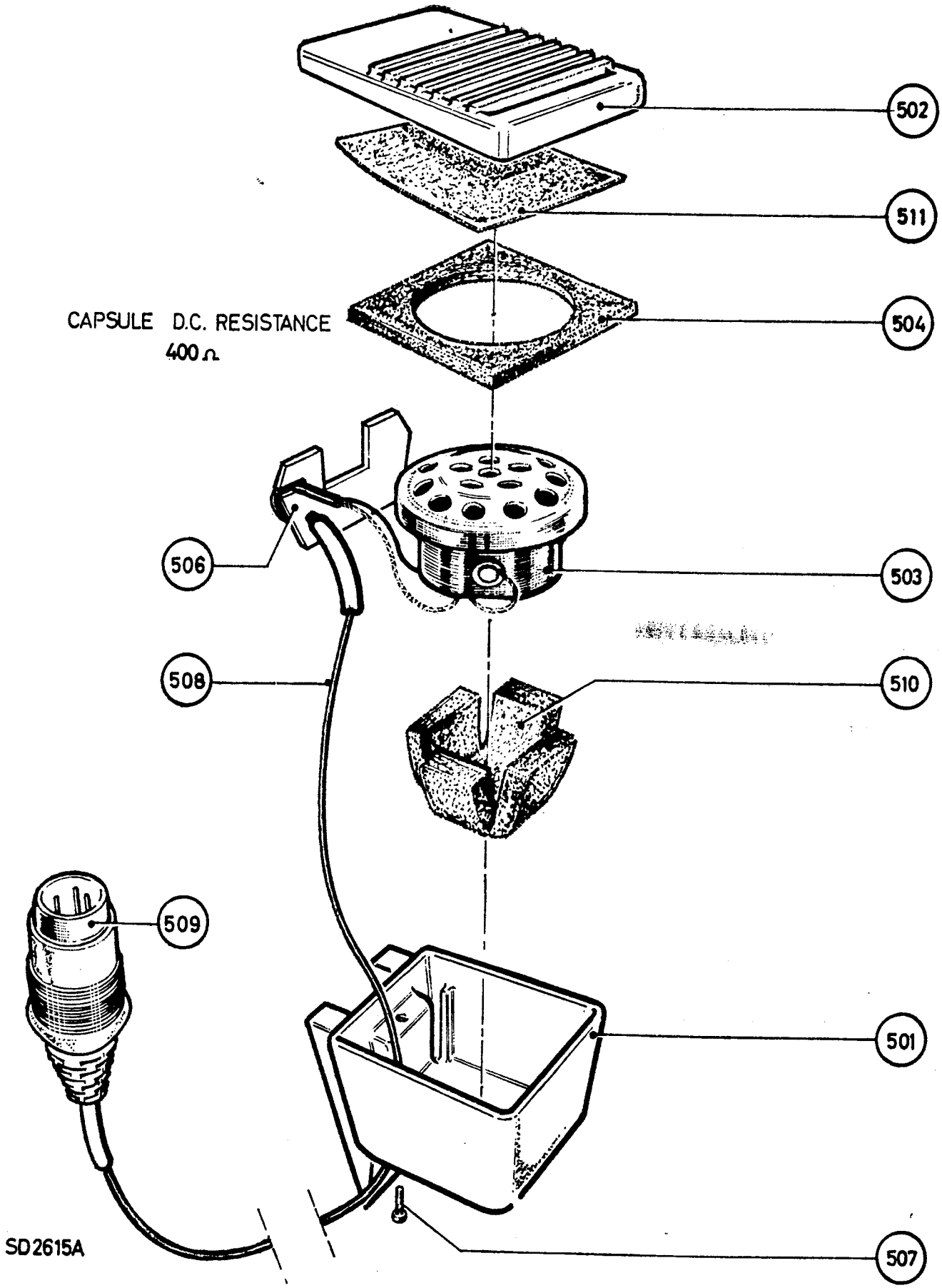


Fig. 23 EL3790 MICROPHONE—exploded view

L—SPARE PARTS LIST

Please quote code and position numbers when ordering spare parts in order to expedite dispatch

CABINET ASSEMBLY

		EL3552A/15A	ST461
26	Lead compartment cover	163.01028	175.01444
27	Tape indication plate	175.01086	*
28	Case—upper	175.01374	175.01456
29	Moulded cover for heads	163.01029	175.01454
30	Key indication strip	175.01142	175.01142
31	Rubber foot (4)	175.01263	175.01263
32	Control knob (2)	175.01271	175.01459
33	Control indication strip	175.01089	*
34	Case—lower	175.01373	175.01455
35	Voltage adaptor plate	AE.152.88	AE.152.88
36	Cover for voltage adaptor	163.01031	175.01453
37	Knob for voltage adaptor	WT.886.86	WT.886.86
38	Loudspeaker grille	*	175.01458
39	Spring for handle (2)	175.01259	175.01259
40	Fibre washer for handle (2)	175.01272	175.01272
41	Screw for handle (2)	999/3 x 30	999/3 x 30
42	Handle	175.01258	175.01457
43	Lid	175.01376	175.01452
44	Lid catch	075.01375	175.01451

* Not available as a separate item

MECHANICAL ASSEMBLY

15	Nut for motor mounting (4)	993/M4
16	Washer	988/4
17	Spacer	990/4.5 x 50
25	Screw for motor mounting (4)	995/4 x 150
50	Turntable L.H.—EL3552A/15A	175.01105
50	Turntable L.H.—ST461	175.01461
51	Felt ring for turntable (2)	175.01281
52	Friction disc (2)	175.01279
53	Washer (2)	175.01341
54	Friction block (8)	175.01343
55	Friction wheel	175.01283
56	Record strip	175.01092
58	Brake block L.H.	175.01285
59a	Brake block small R.H.	175.01347
59b	Brake block small L.H.	175.01347
60	Key—white (4)—EL3552A/15A	163.01019
60	Key—white (4)—ST461	175.01447
60a	L.H. brake bracket	175.01396
61	Key—red—EL3552A/15A	163.01022
61	Key—record—ST461	175.01448
62	Tension spring for keys (5)	175.01292
63	Stop bar—EL3552A/15A	163.01021
63	Stop bar—ST461	175.01445
64	Pause lock/release bar—EL3552A/15A	163.01023
64	Pause lock/release bar—ST461	175.01446
67	Flywheel	175.01094
71	Special washer for pos. 72	175.01349
72	Play strip	175.01287
73	Control bracket for pos. 74	175.01117
74	Wind actuator	175.01338
75	Drive and R.H. brake bracket	175.01337
76	Tension spring for above	175.01385
77	Pause brake block	175.01191
78	Pause strip	175.01294
79a	Forward wind strip	175.01114
79b	Rewind strip	175.01114
80	Tension spring for pause bracket	175.01323
86	Tension spring for pos. 73	175.01344
87	Strip spring for pos. 306	175.01324
90	Nylon bearing plate	163.01024
92	Erase head (K2) (to be used with holder 108)	175.01096
93	Washer for pos. 94a and b (2)	175.01169
94a	Forward wind drive wheel	175.01109
94b	Rewind drive wheel	175.01109
95	Tape guide L.H.	175.01306
96	Ball bearing (4)	89.205.01
97	Brake block R.H.	175.01285
98	Washer for pos. 94a & b (2)	AE.017.48
99	Nylon retaining washer (2)	175.01168
100	Grommet for motor mounting (4)	163.01013
101	Pressure plate and pad assembly	175.01301
102	Pressure arm assembly—EL3552A/15A	175.01383
102	Pressure arm assembly—ST461	175.01443
103	Tension spring on pos. 104	175.01302
104	Coupling assembly for pos. 102	175.01335
106	Screen for record/playback head	175.01098
107	Main drive belt	163.01027
107a	K1 adjustment/mounting screw (2)	068.00668
108	Erase head holder	175.01311
109	Record/playback head assembly (K1)	175.01097
110	Dust excluding washer for capstan bearing	163.01026
111	Mounting spring for K1	WT.730.89
112	Nut for tape guide (2)	175.01422
113	Tape guide R.H.	175.01307
114	Tape guide bracket (2)	175.01305
115	Tension spring for above (2)	175.01304
116	Upper bearing plate assembly	175.01379
117	Turntable R.H.	175.01284
118	Washer (2)	175.01341
119	Drive belt for pos. 120	163.01012
120	Drive wheel	175.01342
121	Upper washer for pressure roller	175.01102
122	Pressure roller	175.01101
123	Lower washer for pressure roller	175.01171
124	Pressure roller bracket	175.01336
125	Tension spring for above	175.01299
126	Tension spring for pos. 101	175.01348
127	Grub screw for pos. 128 (2)	068.00754
128	50/60 c/s pulley and fan assembly	175.01139
129	Motor assembly	175.01382
201	Mounting bracket	175.01145
202	Operating lever for SK1	175.01387
204	Operating lever for SK2	175.01388
205	Tension spring for above	175.01153
207	Auto/manual record button assembly	175.01393
208	Compression spring for above	175.01152
208a	Shutter assembly—EL3552A/15A	175.01392
209	6 pole socket DIN	175.01386
211	Switch locking bar	175.01148
214	Spring—EL3552A/15A	175.01391
215	Tension spring for pos. 202	175.01389

MISCELLANEOUS

Chassis mounting grommet (4)	163.01013
Nut for pots.	914/M10
Mains lead	R.216.KN/07FA
Leaf spring for loudspeaker (2)	175.01176
Base for electrolytic—large	909/V9.4
Base for electrolytic—small	909/V6.6
Anti-static brush	WY.832.07
Plug for pos. 209	978/5 x 180

ELECTRICAL ASSEMBLY

Valves and Semi-conductors etc.

V1	ECC83
V2	EF83
V3	EM87
V4	EL95
T1	AC107
X1	BA100 or OA202
X2	OA79
MR1	SR250B75

Transformers etc.

L1-8	Mains transformer	117.00201
L9-10	Output transformer	A3.289.67
L11	Loudspeaker	940/AD2400
FS1	Insert fuse	A3.425.53

Switches

SK1	Record/playback	175.01155
SK2	Auto/manual	175.01156
SK3	Mains	See R36/37
SK4	Play	175.01151

ACCESSORIES

Microphone assembly

*	Microphone assembly complete	EL3790/00
501	Housing	169.00578
502	Grille	169.00579
503	Capsule	EL6084/10
504	Foam ring	P7.630.84/319
506	Relief plate	V3.190.01
507	Fixing screw	999/2.6×8
508	Lead	R.367.KA/01AA10
509	Plug	978/5×180
510	Sponge block for capsule	P7.630.73/319

Lead Assembly

*	Lead assembly complete	EL3768/03
	Lead only	R.365.KA/56FP9
	Plug DIN	978/5×180
RA1	Resistor	B8.305.80A/1M5

Tape etc.

*	5" Tape (red)	EL3915/50
*	5" Empty spool	EL3912/10

* These and other accessories can be obtained from the General Sales Division of:—

PHILIPS ELECTRICAL LTD.

(Southern)
P.O. Box 130,
17, Beddington Farm Road, Croydon, Surrey.

(Midlands and Northern)
Wellingborough Road,
Sywell, Northants.

(Scotland)
Well Hall Road,
Hamilton,
Lanarkshire.

RESISTORS

		Value Ω	
R1		1K	927/G1K
R2		6.8K	E.001.AD/A6K8
R3		5.6K	901/5K6
R4		22K	901/22K
R5		68K	901/68K
R6		10K	901/10K
R7		22K	901/22K
R8		22	901/22E
R9		470K	901/470K
R10		10M	901/10M
R11		100K	901/100K
R12		100K	901/100K
R13		100	901/100E
R14		22M	902/22M
R15		100K	901/100K
R16		150K	902/K150K
R17		22M	902/22M
R18		100K	901/100K
R19		330K	901/330K
R20		180K	901/180K
R21		150K	902/K150K
R22		100K	902/K100K
R23		68K	901/68K
R24		1.5K	902/K1K5
R25		100K	902/K100K
R26		150K	902/150K
R27		27K	901/27K
R28		2.7M	902/P2M7
R29		100K	901/100K
R31		150K	902/P150K
R32		470K	901/470K
R33		5.6K	901/5K6
R34		22K	901/22K
R35		330	900/330E
R36/37	Mod./Vol	200K+200K Log law	071.00691
R38	Tone	220K Log law	071.00692
*R39	Preset	10K	E.097.AC/10K
R39	Preset	22K	E.097.AC/22K
R40		22M	902/22M
R41		56K	902/K56K
RA1	Lead assembly	1.5M	B8.305.80A/1M5

* Some sets only

CAPACITORS

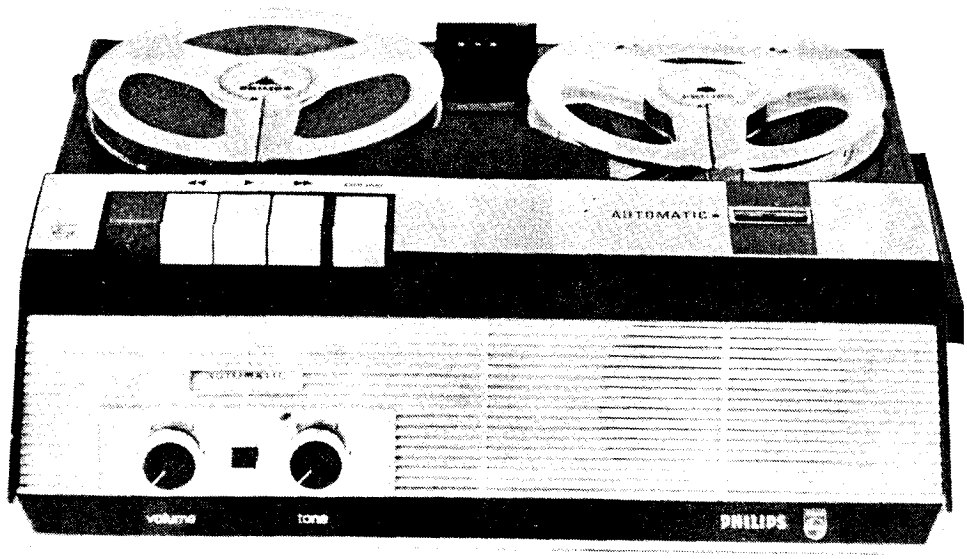
		Value	
C1	Electrolytic	50+32+32uF	A6027
C2	,,	2.5uF	909/W2.5
C3	Pin up	470pF	904/P470E
C4	Electrolytic	32uF	909/Z32
C5	,,	50uF	069.00703
C6	Pin up	4.7KpF	904/P4K7
C7	,,	390pF	904/P390E
C8	Polyester	33KpF	C.296.AC/A33K
C9	,,	0.56uF	906/L560K
C10	Foil	47KpF	C.280.AA/P47K
C11	Pin up	1KpF	C322.BC/1K
C12	,,	10KpF	904/P10K
C13	,,	10KpF	904/P10K
C14	Electrolytic	2uF	AC8608/2
C15	Pin up	270pF	904/P270E
C16	,,	2.2KpF	904/P2K2
C17	Foil	47KpF	C.280.AA/P47K
C18	Pin up	270pF	904/P270E
C19	Polyester	33KpF	C.296.AC/A33K
C20	Pin up	560pF	904/P560E
C21	,,	150pF	904/P150E
C22	Foil	0.1uF	C.280.AA/P100K
C23	Pin up	330pF	904/P330E
C24	Ceramic	4.7KpF	904/4K7
C25	Electrolytic	40uF	C.425.AL/E40
C26	Polyester	39KpF	C.296.AC/A39K
C27	,,	56KpF	906/L56K
C28	Pin up	3.3KpF	C.322.BA/H3K3
C29	,,	3.3KpF	C.322.BA/H3K3
C30	,,	560pF	904/P560E

SERVICE INFORMATION FOR THE

PHILIPS

TAPE RECORDER

TYPE EL3572A/15



OFFICIAL SERVICE AGENT:—

AMALGAMATED ELECTRIC SERVICES LTD.

WADDON FACTORY ESTATE CROYDON CR9 4DR

TELEPHONES DURING BUSINESS HOURS:

Spare part orders: 01-686 7311 General service enquiries: 01-688 7722

AFTER BUSINESS HOURS: Recorded messages on both lines Telex 262308

APRIL, 1967 (Please quote AES 627 when ordering further copies) AES 627

The EL3572A/15 is basically similar to the EL3552A/15A, for which service information has been published (AES 478) and to which reference should be made. Incorporated in the recorder are a 3-digit rev. counter and an extension speaker socket. The cabinet is styled in black polystyrene with silver coloured trim. Supplied with the recorder is a moving coil microphone type EL1976, a reel of L.P. tape, an empty spool and a connecting lead type EL3768/03.

Various differences between the two models are given below:

MECHANICAL CHANGES

1. L.H. turntable replacement (See Section F, para. 2)
The rev. counter is belt-driven from a pulley fitted to the L.H. turntable spindle, below the tape deck. This pulley must be removed before the turntable can be withdrawn from its bearing.

2. Brake adjustment (See Section G, para. 8)
In positions 'Forward wind', 'Rewind' and 'Play', a clearance of at least 1mm. should exist between tongue B on R.H. brake bracket 75 and the stop on wind actuator 74. If necessary, adjust by bending tongue B (see Fig. 1 below).

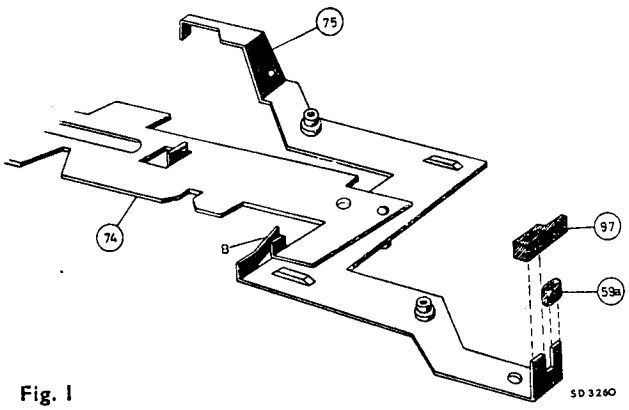


Fig. 1

In the 'Stop' position, brake block 59a should be in contact with the R.H. turntable and the clearance between brake block 59b and the L.H. turntable should be 0.2—0.5mm. If necessary, adjust by bending R.H. brake bracket 75 at point T (see Fig. 12).

When braking after 'Forward wind', brake block 58 (see Fig. 17) should be pulled between small brake block 59b and the L.H. turntable, thus exerting a greater braking force on the latter. To ensure correct functioning, bend brake block tongue C as indicated in Fig. 2 above.

When braking after 'Rewind', brake block 97 (see Fig. 17) should be pulled between small brake block 59a and the R.H. turntable, thus exerting a greater braking force on the latter. For correct operation, ensure that tongues D and E are in line, as shown in Fig. 2 above.

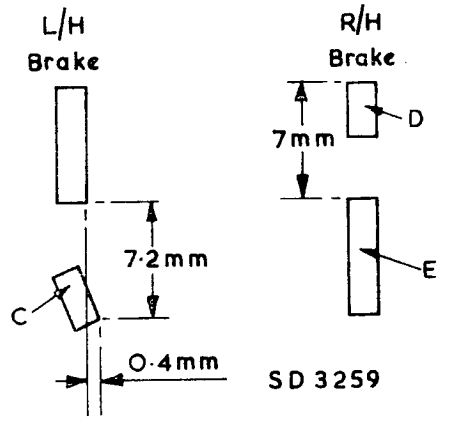


Fig. 2

ELECTRICAL CHANGES

1. Extension speaker socket Bu2
This socket is fitted beside socket Bu1 and is electrically connected as shown in Fig. 3 below.

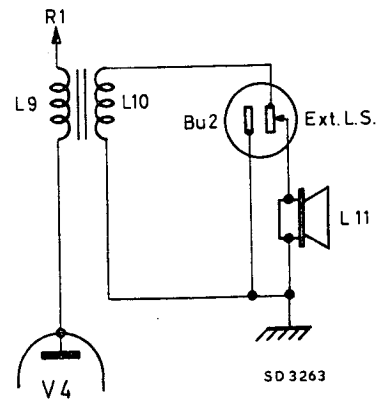


Fig. 3

2. A 1.5MΩ resistor, R42, is connected between pins 1 and 3, Bu1 and a 220 pF capacitor, C31, is connected between pin 3, Bu1 and chassis.

3. C14 is changed from 2uF to 2.5uF.
R33 is changed from 5.6KΩ to 10KΩ.

For spare parts, refer to the Spare Parts List **for the EL3552A/15A only.**

All differences are given below.

SPARE PARTS LIST

SUPPLY OF SPARE PARTS: To ensure correct interpretation of requirements, please include the following information on orders for spare parts.

1. The full type number recorded on the type number plate, including any suffix. **Do not use the commercial abbreviations which may be misleading.**
2. Whenever possible, quote the serial number of the recorder. In some recorders the components have been changed during production.
3. **Always give a brief description** and colour where applicable.
4. Quote part number.

If it is necessary to return components, always include full identification on the accompanying advice note.

CABINET

26	Lead compartment cover	443.60184	33	Control indication strip	175.01089
27	Base for lead compartment	3104.104.06650	34	Case lower	443.50088
28	Case upper	443.30094	36	Cover for voltage adaptor	443..
29	Moulded cover for heads	443.60185	42	Handle	
30	Key indication strip	3104.105.11020	43	Lid	
32	Control knob (2)	413.40277	44	Lid catch	

MECHANICAL

50	Turntable L/H	528.10116
	Pulley for above	175.01297
	Circlip for above	984/3
60	Key grey (4)	410.20459
63	Stop bar	410.20457
64	Pause lock/release bar	410.20458
104	Coupling assembly for posn. 102	175.01439
117	Turntable R/H	528.10117

ELECTRICAL

SEMI-CONDUCTORS, ETC.

MR1	Rectifier	130.50192

SOCKETS

	Ext. speaker socket	3113.100.20070

TRANSFORMERS, ETC.

L11	Loudspeaker	940/AD1400Z
L9/10	Output transformer	104.00837

RESISTORS

		Value Ω		
R33		10K	log law	902/K10K
R36/37	Mod./Vol.	200K+200K		071.01041
R42		1.5M		902/K1M5

CAPACITORS

		Value		
C10	Foil	47KpF		069.01101
C14	Electrolytic	2.5uF		909/M2.5
C17	Foil	47KpF		069.01101
C31	Pin-up	220pF		904/P220E

	Bracket assembly "Z" shaped	403.50196
	Rev. counter	349.50028
	Pulley for above	175.01296
	Circlip for above	WHB.045.TU/2.5
	Belt for rev. counter	358.30023

MISCELLANEOUS

	Spindle for pot	916/01

ACCESSORIES

(Supplied with the recorder)

MICROPHONE ASSEMBLY

	Microphone assembly complete	EL1976/00
1	Housing	447.10095
2a	Lead	219.00131
2b	5-pin plug DIN	978/5 x 180
4	Capsule	EL6072/10
5	Pad (2)	466.60286
6	Front cover	447.10096

LEAD ASSEMBLY

	Lead assembly complete	EL3768/03
	Lead only	R.365.KA/56FP9
	5-pin Plug DIN	978/5 x 180
	Resistor	88.305.80A/1M5

Supplies of magnetic tape (or tape cassettes as applicable) should be obtained from the General Sales Division of Philips Electrical Ltd.

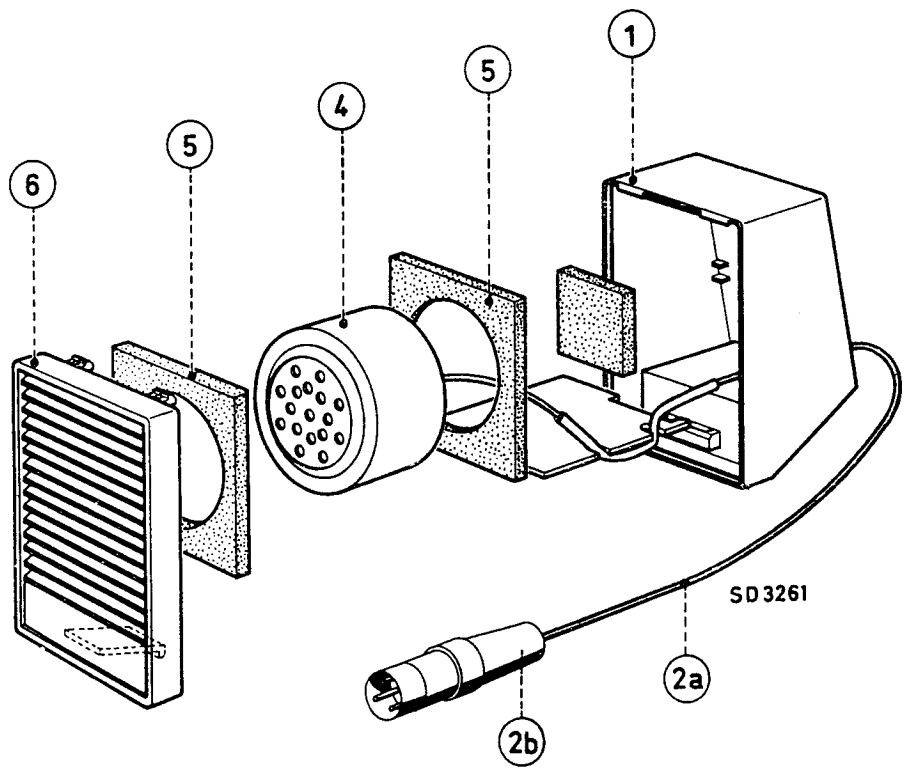


Fig. 4 EL1976 MICROPHONE—EXPLODED VIEW

SERVICE INFORMATION FOR THE

PHILIPS

TAPE RECORDER TYPE N4304

The N4304 is basically similar to the EL3552A/15A, for which service information has been published (AES 478) and to which reference should be made. Incorporated in the recorder are a 3-digit rev. counter and an extension speaker socket. The cabinet is styled in black polystyrene with 'brushed silver' trim. Supplied with the recorder is a moving coil microphone type EL1976, a reel of L.P. tape, an empty spool and a connecting lead type EL3768/03. Various differences between the two models are given below:

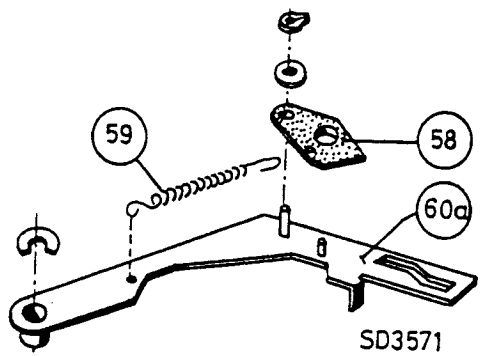


Fig. 2

MECHANICAL CHANGES

1. L.H. turntable replacement (see Section F, para. 2, AES 478)
A pulley is fitted to the L.H. turntable, below the tape deck, for the belt driving the rev. counter. This pulley must be removed before the turntable can be withdrawn from its bearing.

2. Improved brake construction (See Figs. 1 and 2)
In the new brake arrangement, the original left-hand rubber brake shoe has been replaced by a rubber-asbestos brake shoe; while the rubber flap and nylon sleeving of the right-hand brake have been replaced by one special rubber brake shoe (item 97). The adjustment is also simplified and once set, varies less over a longer period.

3. Brake adjustment
Ensure that recorder is in STOP position. Press brake shoe 58, Figs. 1 and 2,, to the left. Bend lug A so that in this position of brake shoe 58, the distance between the right-hand turntable and right-hand brake shoe 97, is 0.5 to 1.0 mm.

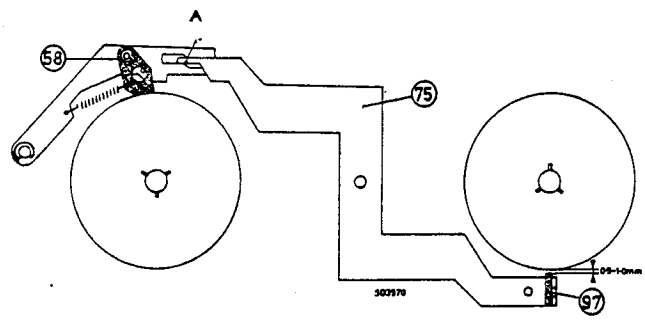


Fig. 1

ELECTRICAL CHANGES

1. Extension speaker socket Bu2
This socket is fitted beside Bu1 and is electrically connected as shown in Fig. 3.
2. A 1.5MΩ resistor, R42, is connected between pins 1 and 3, Bu1 and a 220pF capacitor, C31, is connected between pin 3, Bu1 and chassis.
3. C14 is changed from 2uF to 2.5uF. R33 is changed from 5.6KΩ to 10KΩ.
For spare parts, refer to the Spare Parts List for the EL3552A/15A except for the differences given overleaf.

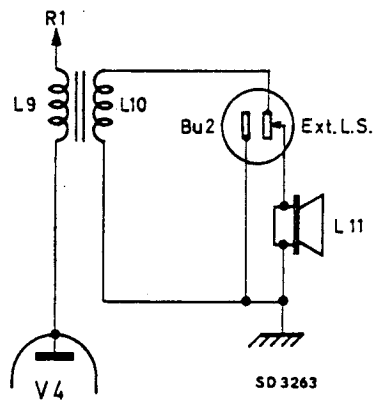


Fig. 3

COMBINED ELECTRONIC SERVICES LIMITED
QUEENSWAY · WADDON FACTORY ESTATE · CROYDON · CR9 · 4DR
TELEPHONES:
Spare part orders: 01-686 7311
General service enquiries: 01-688 7722
After business hours: Recorded messages on both lines.
Telex 262308

APRIL, 1968
CES 678
(Please quote CES 678 when ordering further copies)

SPARE PARTS LIST

SUPPLY OF SPARE PARTS: To ensure correct interpretation of requirements please include the following information on orders for spare parts.

1. The full type number recorded on the type number plate, including any suffix. **Do not use the commercial abbreviation which may be misleading.**
2. Whenever possible, quote the serial number of the recorder. In some models the components have been changed during production.
3. **Always give a brief description** and colour where applicable.
4. Quote part number.

If it is necessary to return components, always include full identification on the accompanying advice note.

CABINET ASSEMBLY

26	Lead compartment cover	443.60184
27	Base for lead compartment	3104.104.06650
28	Case upper	443.30094
29	Moulded cover for heads	443.60185
30	Key indication strip	3104.105.11020
32	Control knob (2)	413.40277
33	Control indication strip	175.01089
34	Case lower	443.50088
36	Cover for voltage adaptor	443.60197
42	Handle	498.30031
43	Lid	443.20033
44	Lid catch	411.60102

MECHANICAL

50	Turntable L.H.	528.10116
	Pulley for above	175.01297
	Circlip for above	984/3
58	Brake block	466.40071
59	Tension spring	492.30416
60	Key grey (4)	410.20459
60a	Brake bracket L.H.	403.10096
63	Stop bar	410.20457
64	Pause lock/release bar	410.20458
67	Flywheel	528.60049
75	Drive and R.H. brake bracket	403.50437
90	Thrust bearing (for item 67)	163.01024
97	Brake block R.H.	466.40069
102	Pressure arm assy.	403.50438
104	Coupling assembly for position 102	175.01489
117	Turntable R.H.	528.10117
126	Tension spring (for item 101)	492.30389
	Rev counter	349.50028
	Pulley for above	175.01296
	Circlip for above	WHB.045.TU/2.5
	Belt for rev counter	358.30023

MISCELLANEOUS

	Spindle for pot	916/01

ELECTRICAL

SEMI-CONDUCTORS, Etc.

MR1	Rectifier	130.50192

SOCKETS

Bu2	Extension speaker socket	3113.100.20070

TRANSFORMERS, Etc.

L9/10	Output transformer	104.00837
L11	Loudspeaker	940/AD1400Z

RESISTORS

		Value Ω		
R33		10K		902/K10K
R36/37	Mod./Vol.	200K+200K	log law	071.01041
R42		1.5M		902/K1M5

CAPACITORS

		Value pF		
C10	Foil	47K		069.01101
C14	Electrolytic	2.5uF		909/M2.5
C17	Foil	47K		069.01101
C31	Pin-up	220		904/P220E

ACCESSORIES

MICROPHONE ASSEMBLY

	Microphone assembly complete	EL1976/00
1	Housing	447.10095
2a	Lead	219.00131
2b	5-pin plug DIN	978/5×180
4	Capsule	EL6072/10
5	Pad (2)	466.60286
6	Front cover	447.10096

LEAD ASSEMBLY

	Lead assembly complete	EL3768/03
	Lead only	R.365.KA/56FP9
	5-pin plug DIN	978/5×180
	Resistor	B8.305.80A/1M5

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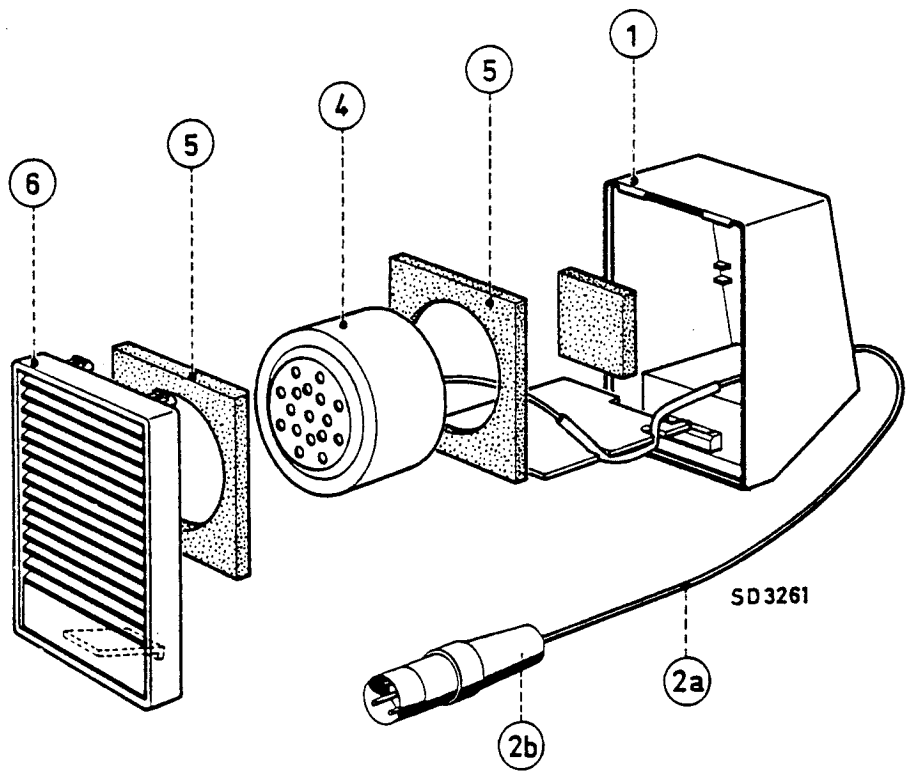

Fig. 4 EL1976 MICROPHONE—EXPLODED VIEW