FERGUSON TAPE RECORDER MODEL 442TR

SERVICE MANUAL

SPECIFICATION

Mains Supply
50 cps alternating current 200-225 and 225-250 volts

Power Consumption
60 watts on both record and replay

Magnetic Heads
Standard quarter track
Two record/play stacked
Two erase (double gap) stacked

Frequency Range
50-10,000 cps

Controls
Combined volume control and recording level control
Mains On/Off switch combined with a continuously variable tone control

Switching Facilities
A record switch interlocking with the Record/Replay control to prevent accidental erasure
Track selector switch
Straight through amplifier switch

Tape Speed
$3\frac{3}{4}$ inches per second

Record Level Indicator
Cathode-ray type (EM84) peak indicator

Tape
The Tape Recorder is supplied with a $5\frac{3}{4}$ inch spool of LP tape

Playing Time
The following list gives the playing times for various spool sizes of LP tape, the grade of tape recommended for general use

Size	Feet (per track)	Playing Time (minutes per track)
3 inch	300	16
5 inch	900	48
$5\frac{3}{4}$ inch	1255	66

Rewind Time
Fast forward and fast rewind. 3 minutes for $5\frac{3}{4}$ inch reel of standard tape ($4\frac{3}{4}$ ft/sec)

Sockets
Microphone input : 2mV into 10MΩ
Radio input : 2mV into 22KΩ
Pick-up input : 100mV into 1MΩ
Radio output : 500mV at 22KΩ
External loudspeaker : 2.5W at 3Ω
Automatic muting of internal loudspeaker with external loudspeaker plug inserted

Loudspeaker
7 inches x $3\frac{1}{2}$ inches elliptical loudspeaker

Cabinet Dimensions
$14\frac{3}{4}$ inches wide x $12\frac{1}{4}$ inches deep x 7 inches high

Weight
(Including microphone, two tape spools, etc.) 17 lbs

The manufacturers reserve the right to vary specifications or use alternative materials as may be deemed necessary or desirable at any time.

SERVICE NOTES AND ADJUSTMENTS

Chassis Removal

1. Remove tape spools and any plug connections.
2. Lift off head cover.
3. Pull off four control knobs (Volume, tone, Record/Play and Mechanism control).
4. Unscrew six top cover fixing screws (replace serial No. label when re-assembling).
5. Lift off top cover.
6. Unscrew four chassis fixing screws and washers.
7. The chassis is now free to be removed from the case. The loudspeaker leads are of sufficient length for most servicing requirements.

Cleaning

Before attempting any cleaning maintenance the recorder must be disconnected from the mains supply.

Do not allow a screwdriver or anything made of iron or steel to come in contact with the recording heads. The working face of the magnetic heads, capstan and pinch wheel need occasional cleaning. Use a soft cloth, dampened with methylated spirit and place over a matchstick or wooden spill to clean tape guides as well as the record and erase heads. **DO NOT USE PETROL OR CARBONTETRACHLORIDE.**

Heater Balance

A humdinger R26 is provided across the mains transformer heater winding. This has been set during manufacture and should not need altering. If adjustment does become necessary, the procedure given below must be carefully followed.

Whilst setting the adjustment the chassis must be electrostatically screened, particularly around V1 and the input sockets. A shallow metal box, of suitable size and connected to the chassis metalwork, may be used.

Take off the tape spools and set the instrument to "record". Connect a sensitive valve voltmeter, between the junction of C8/R16 and chassis.

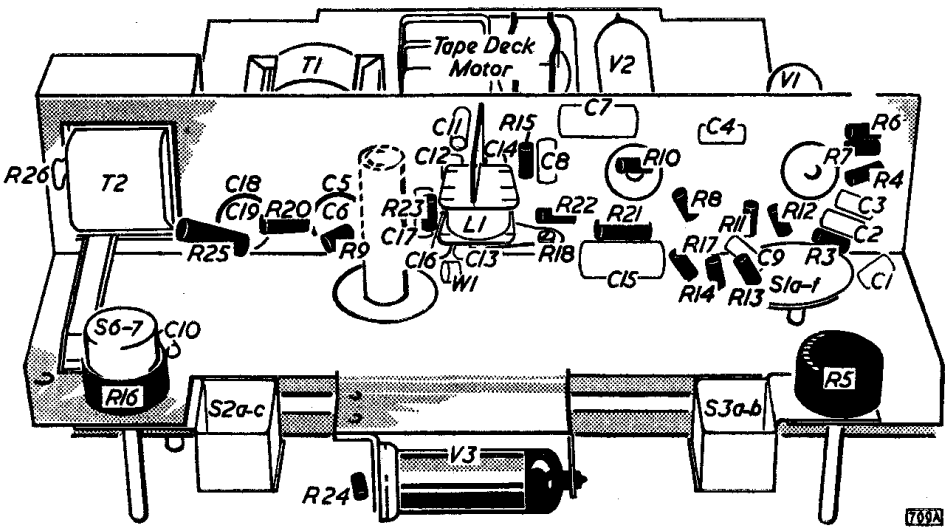
Short circuit R18 to prevent the oscillator from functioning and plug in a dummy microphone connector consisting of a 1000pF capacitor strapped across the plug.

Switch on and allow to warm up for 10 minutes.

Adjust R26 for minimum reading on the valve voltmeter (approximately 80mV).

Oscillator Level

Set instrument to "Record" and connect valve voltmeter across the top winding of erase head. Switch on and allow to warm up for 10 minutes. Select track "1-4" and adjust R18 for a reading of 14 volts. Connect valve voltmeter to the lower winding of erase head and select track "2-3". If reading is less than 14 volts readjust R18 for this figure.



Chassis component layout.

Head Adjustment

Two adjusting screws are provided on each head mounting to enable the heads to be accurately aligned. Do not overtighten otherwise the head mounting might become distorted.

One of the screws on the record/replay head is fitted with a spring washer, adjust this screw so that the spring is lightly compressed, then align the head gap so that it is visually at right angles to the tape motion. Select tracks "1-4" and replay a standard alignment tape. Adjust screw without spring washer for maximum output meter reading. Note setting of this screw (pencil mark on chassis). Select tracks "2-3" and adjust the screw for maximum output meter reading on alignment signal. Mark this setting and adjust screw to midway between the two marks, to obtain a compromise alignment for both tracks. To realign the erase head, ensure that the gaps are visually at right angles to the tape motion, and make final adjustments to obtain complete erasure on a previously recorded tape.

Head Demagnetisation

It is important that there is no residual magnetism in the magnetic heads or any other part in close proximity to the recording tape such as the capstan and tape guides.

If these become slightly magnetised in use, the background noise on the recordings will increase. Suitable instruments for providing a demagnetising field are available from a number of manufacturers.

Microphone

Due to difficulty in re-assembling and danger of damage to the crystal element, it is suggested that no servicing is carried out on the microphone. In the case of any fault developing in the component it should be returned to the nearest service depot.

Tape Deck

A chart of the more common faults and their remedies is given on page 4. Should any component be found faulty and worn, replacement parts can be obtained direct from Birmingham Sound Reproducers Ltd., by quoting part number (see exploded view on page 5).

CIRCUIT DESCRIPTION

The AC mains supply is switched to the primary of **T2** and tape deck motor by a double pole switch **S6-7.** **T2** primary is tapped to provide two alternative ranges of mains input voltages. HT supply is provided by a full wave selenium metal rectifier **W2** type EC1. The parallel heater chain is balanced to chassis by means of a preset potentiometer **R26** across the heater winding of **T2.**

Replay

The head winding for the appropriate track is selected by the track selector switch **S2a/S2b.** The head output voltage is switched by **S1a** to the grid of **V1A** (ECC83), the other side of the head winding being returned to chassis via **S1b.** The amplified signal at **V1A** anode is then fed via the volume control **R5** to the grid of **V1B,** which, with **V2A** (ECL82) provides two further stages of amplification. A frequency selective feedback loop, switched by **S1c** from **V2A** anode to **V1B** cathode, gives bass boost playback equalisation. A measure of correction for HF head losses is applied by resonating the head with **C1.**

V2A output is fed direct to the "radio" output socket via potential divider **R13/14** and **S1d** and via **C8** to tone control **R16.** From the tone control the signal is switched by **S1f** to the grid of **V2B** via a grid stopper **R17.** **V2B** operates as the audio output stage, with the erase head short circuited by **S1e.** The secondary of **T1** is connected in the return circuit of the cathode of **V2B** to provide negative feedback. The internal loudspeaker is automatically muted when the external loudspeaker connection is made at the jack socket.

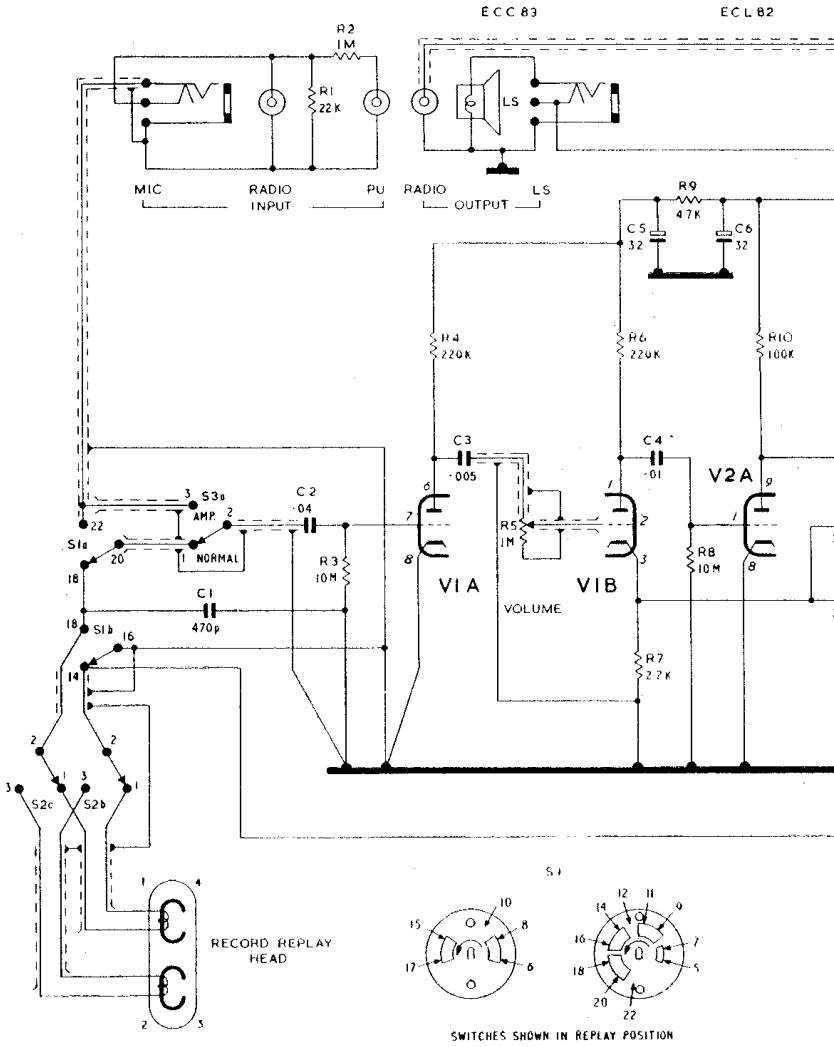
Record

The input sockets are switched to **V1A** grid by **S1A** or **S3** (Note: The position of **S3** is immaterial during recording). Switch contacts are incorporated in the microphone jack to break the radio and pick-up input circuit when the microphone is in use. **V1A** output is fed via the record level control **R5** to **V1B** grid. Negative feedback is applied via **S1c** and **R11.** Treble boost is applied by resonating the head with **C11.**

V2A output is fed to the record/playback head via **C8** and a series resistor **R15,** to provide constant current drive. The record/replay head winding is returned to chassis through **S1b.** Part of the signal developed at **V2A** anode is rectified by **W1,** and fed to the grid of **V3** the record level indicator. The values of **C17** and **R23** in **V3** grid circuit have been chosen to allow peak programme levels to be indicated whilst retarding the return to lower volume levels. Power for erasing and recording bias is supplied by **V2B** which is connected as a modified Hartley oscillator when the instrument is switched to "Record." The oscillator is tuned to approximately 54Kc/s by **L1/C12** and the output is fed from the secondary winding of **L1** to the erase head via **S5a/S2c** and to the recording head through **C11** and **S2B.**

Superimpose

S5a switches out the erase head and connects a resistive load into circuit to maintain correct oscillator operating level.



Model 442TR Circuit Diagram. Figures in rectangles are voltage readings taken with a 20,000 ohm/volt meter. Figures adjacent to the valve electrodes denote pin connections.

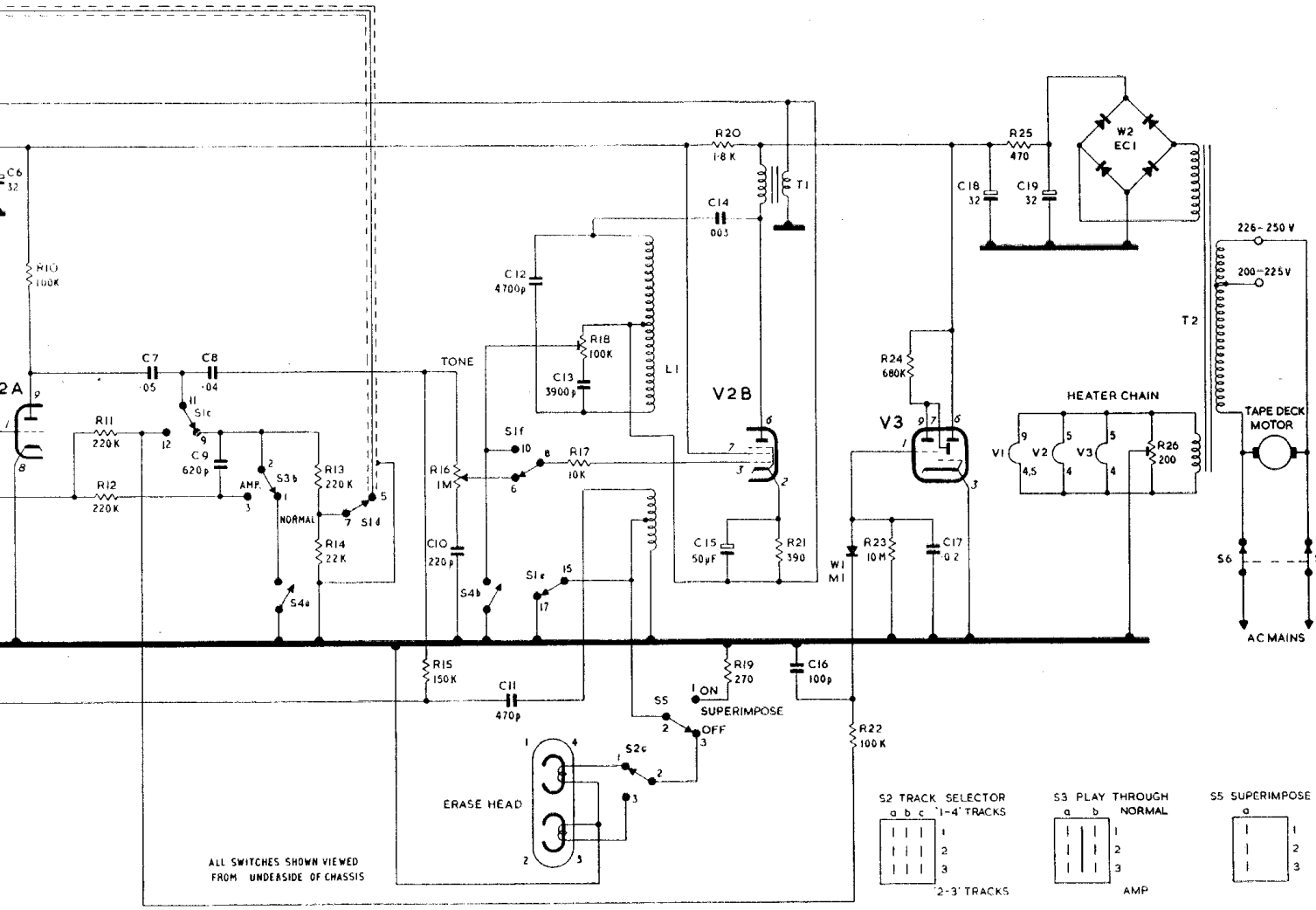
Playthrough

When used as a "playthrough" amplifier, the record/play switch must be left in the play position. The playthrough switch **S3A** disconnects the record/play head from **V1A** grid and brings the input sockets into circuit. The other section of the playthrough switch (**S3b**) shortcircuits **C9** in the negative feedback loop, removing bass boost.

Muting Switch

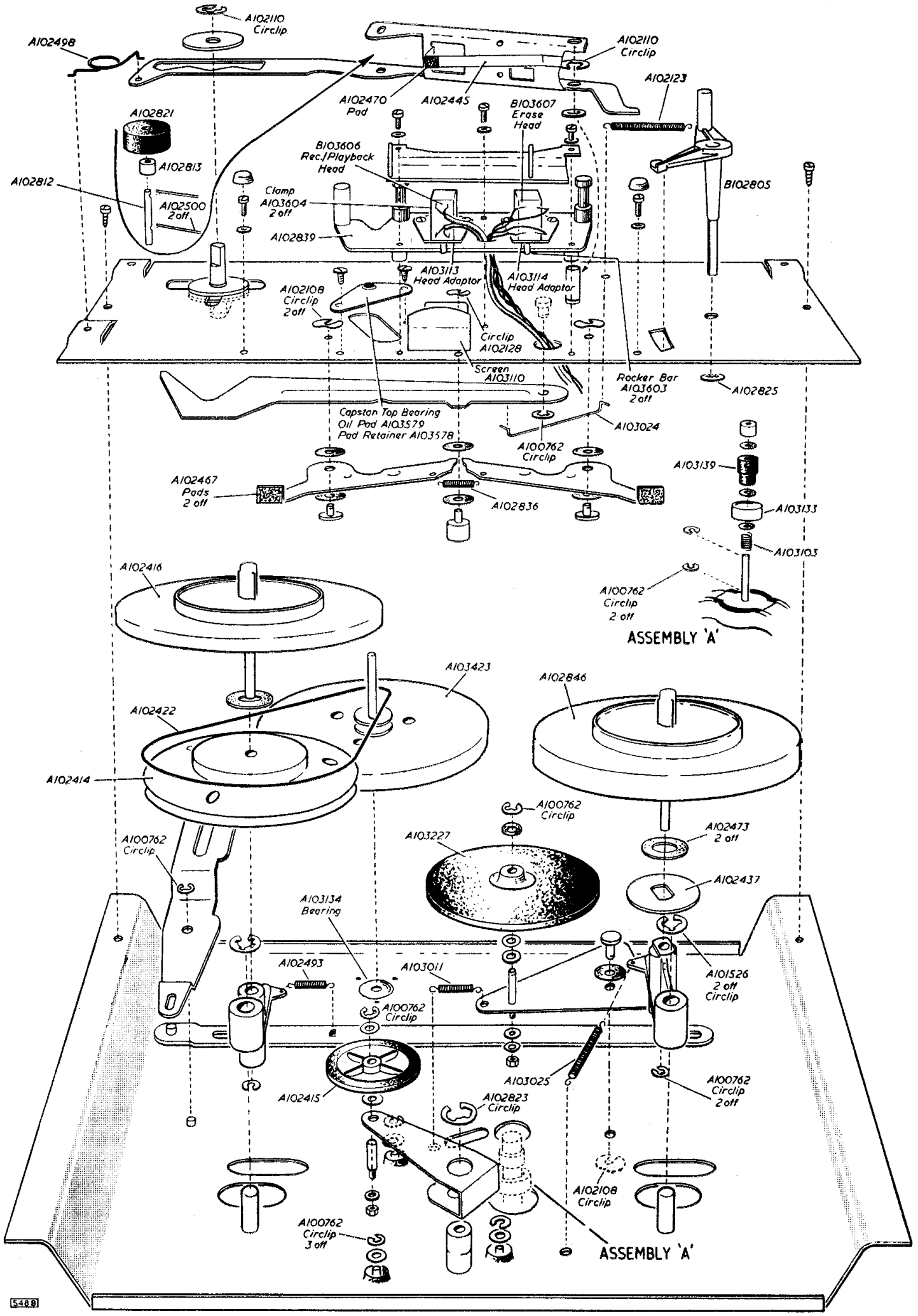
S4a shorts the signal at **V2A** anode to chassis thus muting the signal during fast rewind and, hum and noise when the mechanism control is in the off position.

S4b produces decaying oscillations so ensuring that the erase head is not left partially magnetized.



SERVICE CHART

SYMPTONS	CAUSE	REMEDY
(1) Tape does not move when unit is switched on and control knob is in operating position	(1) No current to motor	Check mains supply to motor
	(2) Defective motor	Repair or replace
	(3) Intermediate wheel slipping	Wipe clean of grease or oil ; replace wheel if distorted
	(4) Pressure roller not pressing tape firmly against capstan	(a) Check that pressure roller spindle is free to move in slot and that the springs push the spindle towards the front of the slot (b) Check that the pressure lever assembly moves with a positive action
	(5) Tape jamming in guide due to faulty splicing or accumulation of dust	Free tape and clean tape guides
	(6) Tape slip at capstan	Clean capstan and pressure roller and ensure that they are free from oil and grease
(2) Take-up spool does not rotate	Driving belt from capstan to friction pulley assembly detached	Replace belt in driving groove of capstan and friction pulley
(3) No movement or slow movement of tape on fast forward or rewind position	(1) Support arm spring strained or detached	Replace spring
	(2) Spool support casting tight on spindle	Remove and clean. Assemble with light grease
	(3) Slip between motor pulley and spool carrier	Clean motor pulley, jockey pulley and rim of spool carrier
(4) Tape spills when applying brakes, during normal playing or on fast forward or rewind	(1) Brake arms not operating due to detached or strained brake arm spring	Replace spring
	(2) Brake arms sticking	Check that brake arms move freely under the action of spring. Examine arms for distortion etc.
	(3) Brakes slipping	Clean brake pad and rim of spool carrier and ensure that they are free from oil and grease
(5) Variation of tape speed	See causes 3, 4, 5 and 6 of Symptom (1)	
(6) Variation of sound volume	(1) Accumulation of dust on face of playback head	Clean head face
	(2) Damaged or distorted pressure pad spring	Adjust pad and spring, pressure should be 15-20 grms
	(3) Defective amplifier	Check amplifier and speaker


A102110 Circlip
A102498
A102110 Circlip
A102123
A102470 Pad
A102445
B103607 Erase Head
A102821
A102813
B103606 Rec./Playback Head
A102812
A102500 2 off
Clamp A103604 2 off
B102805
A102839
A103113 Head Adaptor
A103114 Head Adaptor
A102108 Circlip 2 off
Circlip A102128
Screen A103110
Rocker Bar A103603 2 off
A102825
Capstan Top Bearing Oil Pad A103579 Pad Retainer A103578
A103024
A100762 Circlip
A102467 Pads 2 off
A102836
A103139
A103133
A103103
A100762 Circlip 2 off
ASSEMBLY 'A'
A102416
A103423
A102846
A102422
A102414
A100762 Circlip
A103227
A102473 2 off
A102437
A100762 Circlip
A103134 Bearing
A102493
A103011
A101526 2 off Circlip
A100762 Circlip
A102415
A103025
A100762 Circlip 2 off
A102823 Circlip
A102108 Circlip
A100762 Circlip 3 off
ASSEMBLY 'A'
5489

RESISTORS

All ¼ Watt carbon 20% tolerance unless otherwise stated

Ref	Value	Rating	Function and Part No.
R 1	22KΩ	10%	Radio input and part pick-up attenuator
R 2	1MΩ		Part pick-up input attenuator
R 3	10MΩ		V1A grid leak
R 4	220KΩ	5% Low Noise	V1A anode load
R 5	1MΩ	Log Pot	Volume/Record level control 13144
R 6	220KΩ		V1B anode load
R 7	2.2KΩ	10%	V1B cathode bias and NFB injection
R 8	10MΩ		V2A grid leak
R 9	4.7KΩ		Part HT smoothing
R10	100KΩ		V2A anode load
R11	220KΩ	10%	Part record NFB (treble boost)
R12	220KΩ	10%	Replay NFB (bass boost)
R13	220KΩ	}	Radio output attenuator
R14	22KΩ	}	
R15	150KΩ	10%	Record head signal feed
R16	1MΩ	Lin Pot	Tone control 13145
R17	10KΩ		V2B grid stopper
R18	100KΩ	Pre-set	Oscillator amplitude control
R19	270Ω	5% ½W	Oscillator load (superimpose)
R20	1.8KΩ	10% ½W	Part HT smoothing
R21	390Ω	10% ½W	V2B cathode bias
R22	100KΩ		W1 stand off
R23	10MΩ		V3 grid leak and W1 load
R24	680KΩ		V3 anode load
R25	470Ω	10% 1W	Part HT smoothing
R26	200Ω	Pre-set	Heater balance (humdinger)

MISCELLANEOUS

Ref	Description	Part No.
LS	7 inches x 3½ inches elliptical 3Ω speech coil	16009/1
S1a-f	Record/Play switch	30366
S2a-c	Track selector switch	30435
S3a-b	Playthrough switch	30435
S4a-b	Muting switch	30358
S5	Superimpose switch	18399
S6-7	Mains On/Off switch	13145
W1	Record level rectifier	18296
W2	HT rectifier	17599

CAPACITORS

All 350 Volts 20% tolerance unless otherwise stated

Ref	Value	Rating	Function and Part No.
C 1	470pF	2½%	Replay head tuning
C 2	.04uF	150V	V1A grid coupling
C 3	.005uF	400V	V1B grid coupling
C 4	.01uF	400V	V2A grid coupling
C 5	32uF	Elec 275V }	HT smoothing 13236/10
C 6	32uF	Elec 275V }	
C 7	.05uF		V2A anode DC blocking
C 8	.04uF	150V	Part low frequency attenuator
C 9	620pF	10%	Replay NFB (bass boost)
C10	220pF		Part tone control
C11	470pF	2½%	Record bias feed and record head tuning
C12	4700pF	2½%	Oscillator tuning
C13	3900pF	500V	Oscillator grid drive coupling
C14	.003uF	300V AC	Oscillator anode coupling
C15	50uF	Elec 25V	V2B cathode bypass 13228/4X
C16	100pF		W1 decoupling
C17	.02uF	150V	Level indicator time constant
C18	32uF	Elec 300V	HT smoothing 13236/13
C19	32uF	Elec 300V	HT reservoir

INDUCTOR AND TRANSFORMERS

Ref	Description	Part No.
L1	Bias oscillator coil	30354/1
T1	Audio output transformer	18313
T2	Mains transformer	18312

SPARE PARTS LIST

Description	Part No.
Cabinet	30403
Connecting lead	30393
Control knobs :	
Volume Control } (clip 45931)	25157/2
Tone control }	
Record/Play } (clip A102635*)	A102456*
Mechanism control }	
Cover (moulded)	18398/3
Fillister head fixing screw for above	SB4F04/N
Head cover	30407
Microphone	30391
Tape deck	30405

Manufacturers . . .

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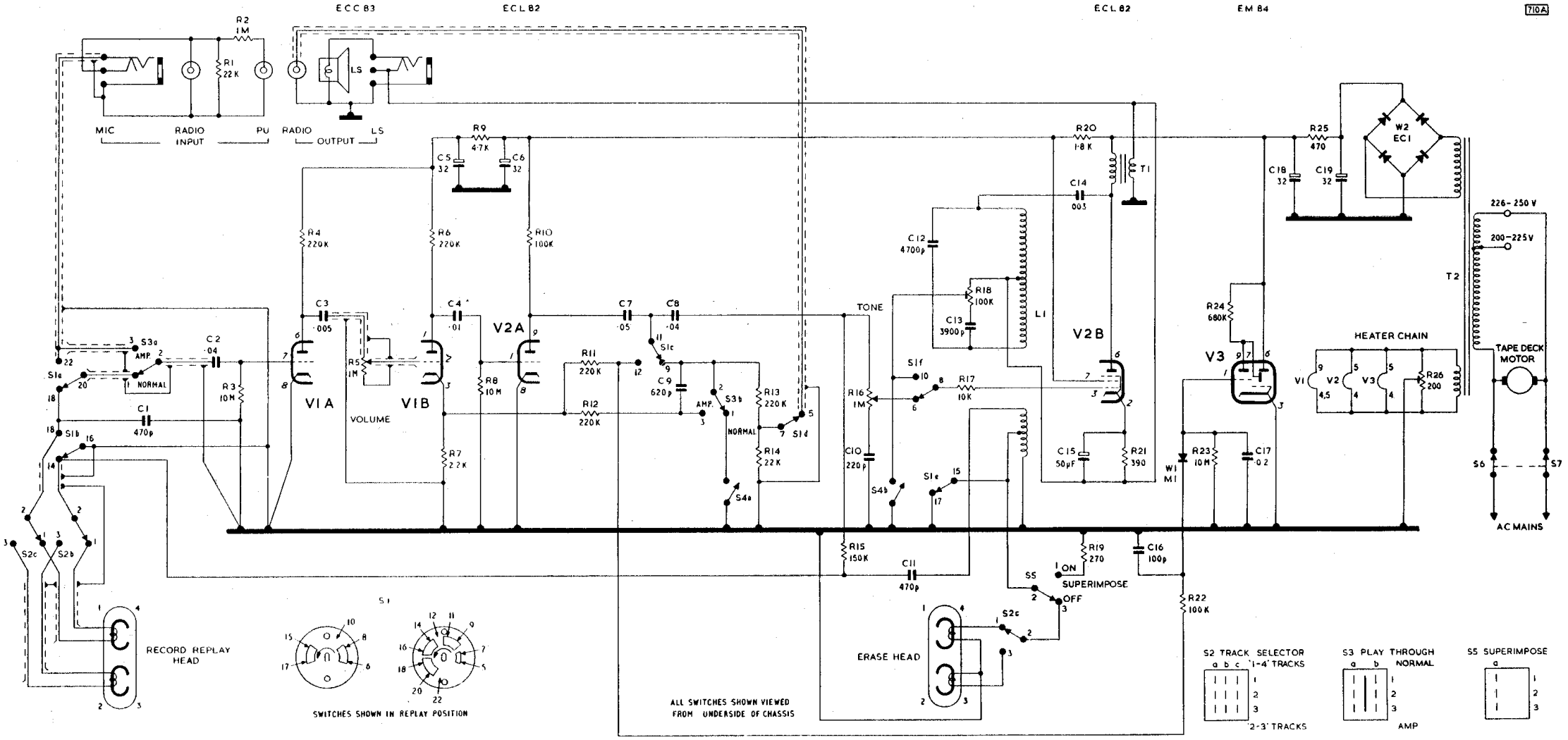

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