

SERVICE MANUAL

SPECIFICATION

Mains Supply

50 cps alternating current, 200-250 Volts

Power Consumption

60 Watts on both record and play

Magnetic Heads

International standard half track
 One record/play
 One erase (double gap)

Frequency Response

50-10,000 cps

Controls

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

Switching Facilities

A record switch interlocking with the Record/Replay control to prevent accidental erasure, and internal loudspeaker muting switch

Tape Speed

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

Record Level Indicator

Cathode-ray type (EM84) peak indicator

Playing Time

SIZE	STANDARD		LONG PLAY		DOUBLE PLAY	
	FEET (per track)	PLAYING TIME (minutes)	FEET (per track)	PLAYING TIME (minutes)	FEET (per track)	PLAYING TIME (minutes)
3"	200	10	300	16	400	22
5"	600	32	900	48	1200	64
5 $\frac{3}{4}$ "	850	46	1255	66	1700	90



Rewind Time

Fast forward and fast rewind. 3 minutes for 5 $\frac{3}{4}$ inch reel of standard tape

Input Facilities

- (a) Microphone input : 1.5mV into 10M Ω
- (b) Radio input : 1.5mV into 22K Ω
- (c) Pick-up input : 75mV into 1M Ω
- (d) Radio output : 500mV at 22K Ω source impedance (Minimum load 50K Ω)
- (e) Extension loudspeaker socket : 2.5 Watts at 3 Ω

Loudspeaker

8 inches x 3 inches elliptical internal loudspeaker. External loudspeaker socket, 3 Ω impedance

Cabinet Dimensions

14 $\frac{3}{4}$ inches wide x 12 $\frac{1}{4}$ inches deep x 6 $\frac{1}{4}$ inches high overall

Weight (Overall)

Mk. I, 15 $\frac{1}{2}$ lbs. ; Mk. II, 20 $\frac{1}{2}$ 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

Switch off and disconnect recorder from the mains supply, remove tape spools and head cover. Pull off four control knobs. These are a tight fit and may be pulled off with the aid of a stout cord placed around the knob boss. Unscrew the top cover retaining screws* and lift off top cover. The tape deck, complete with chassis and socket panel is secured by four self-tapping screws and, when these have been removed, the assembly can be lifted out of its case. The loudspeaker leads are long enough for most servicing requirements.

The retaining screw located under the head cover also retains the serial number plate which should be refitted when re-assembling recorder.

* Six top cover retaining screws in all current production; four in early models.

Cleaning

Before attempting any cleaning main-

tenance the recorder must be disconnected from the mains supply.

Do not allow a screwdriver or anything made of iron or steel to come into 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 R28 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 metal work, may be used.

Take off the tape spools and set the instrument to "record." Connect a sensitive valve voltmeter between the junction of C20/R16 and chassis.

Short circuit R21 to prevent the oscillator from functioning and plug in a dummy microphone connector with a 1000pF capacitor strapped across the pin tags.

Switch on and allow to warm up for 10 minutes.

Adjust R28 for minimum reading on the valve voltmeter (approximately 80mV).

Head Adjustment

Adjusting screws are provided on each head mounting to enable the heads to be accurately aligned.

Slacken off both screws and make complementary adjustments to both. When the optimum position is found, set the head by means of the screw not fitted with a compression spring and then tighten up the other screw to ensure the head is securely held in position. Avoid overtightening as the head mounting might become distorted.

Adjust the erase head to ensure complete erasure on a previously recorded tape.

To adjust the record/play head, play back a test tape, incorporating a 5Kc/s alignment band, with an output meter connected across the external loudspeaker socket. Adjust head alignment for maximum output, at the same time altering the volume control setting to keep the output level at approximately 50mW.

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 this 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 3. Should any component be found faulty or worn, replacement parts can be obtained direct from Birmingham Sound Reproducers Ltd., by quoting part number (see exploded view on page 5).

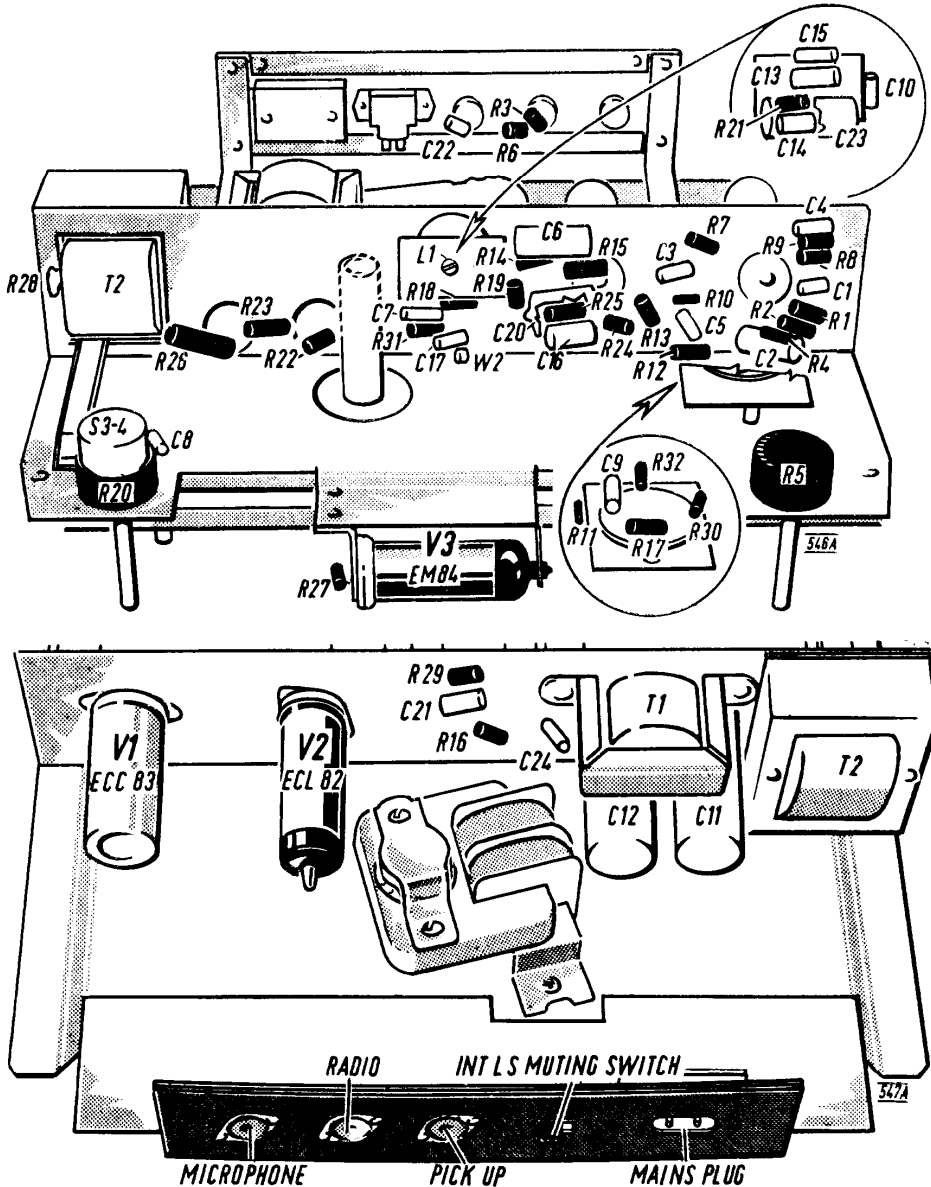


Fig. 1. Component locations.

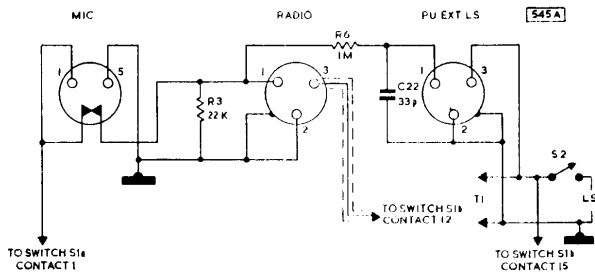


Fig. 2. 441TR Mk. I Sockets

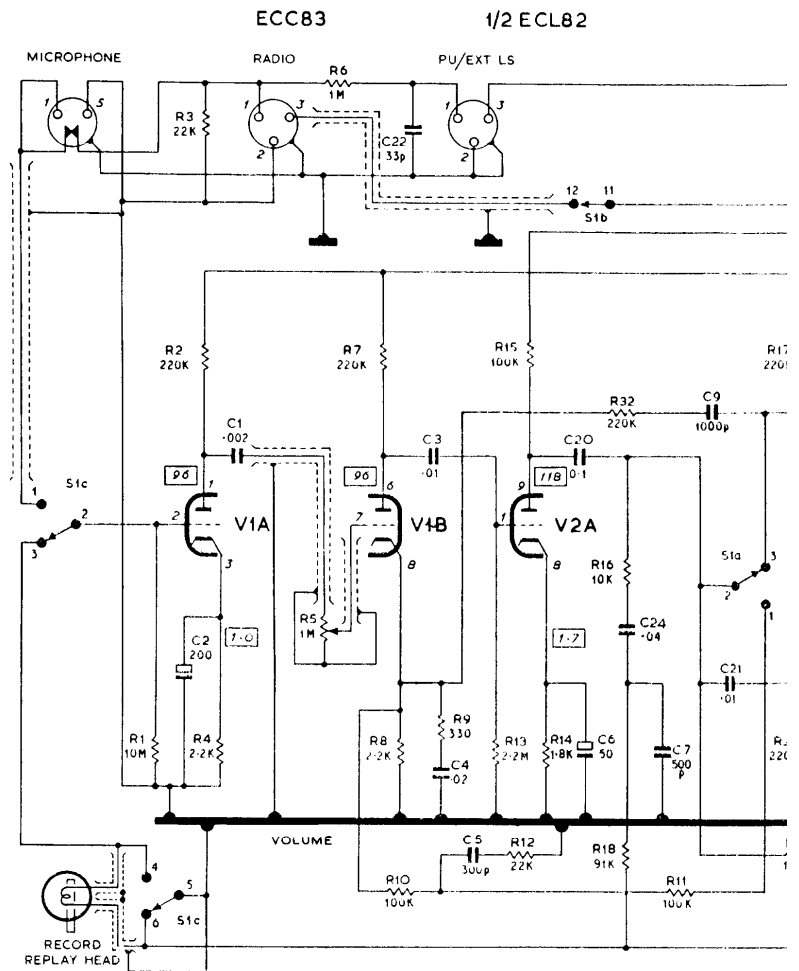
CIRCUIT NOTES

Fig. 3. MODEL 441TR MK II 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.

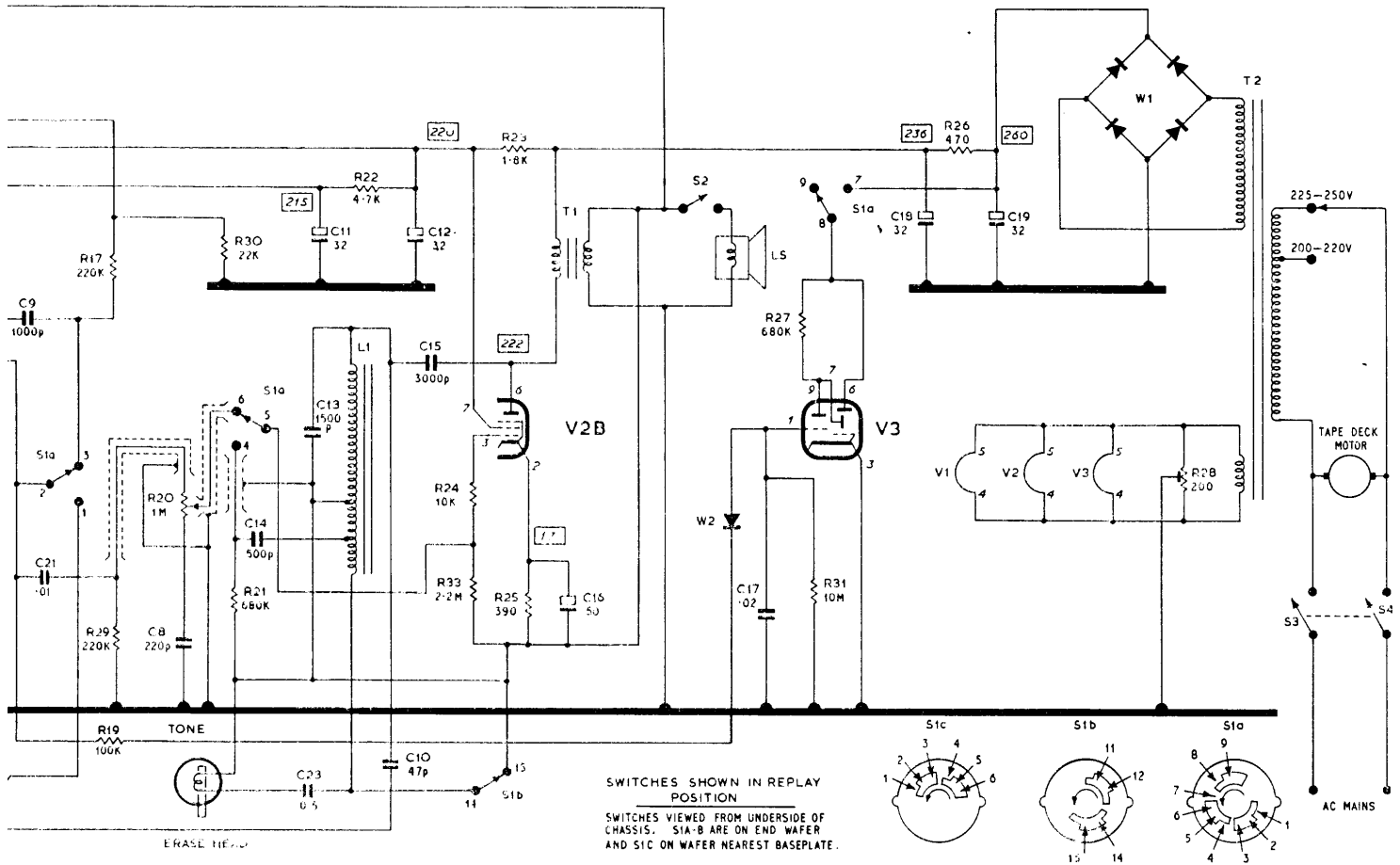
MODEL 441TR MK I CIRCUIT differs as follows :

- (1) Socket input circuit as shown in Fig. 2.
- (2) R33 is omitted, V2B grid return to chassis being through R29 on playback and R21 on record.



SERVICE CHART

Symptoms	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) Driving belt not in position on motor pulley and flywheel (Mk I). Intermediate wheel slipping (Mk II).	Replace belt in driving grooves of pulley and flywheel
	(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 guides 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 Replace belt in driving groove of capstan and friction pulley
(2) Take-up spool does not rotate	Driving belt from capstan to friction pulley assembly detached	Replace spring
(3) No movement or slow movement of tape on fast forward or rewind position	(1) Support arm spring strained or detached	Remove and clean. Assemble with light grease
	(2) Spool support casting tight on spindle	Clean motor pulley, jockey pulley, and rim of spool carrier
	(3) Slip between motor pulley and spool carrier	Replace spring
(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	Check that brake arms move freely under the action of spring. Examine arms for distortion, etc.
	(2) Brake arms sticking	Clean brake pad and rim of spool carrier, and ensure that they are free from oil and grease
	(3) Brakes slipping	
(5) Variation of tape speed	See causes 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



CIRCUIT DESCRIPTION

The AC mains supply is switched to the primary of T2 and tape deck motor by a double pole switch S3-4. T2 primary is tapped to provide two alternative ranges of mains input voltages. HT supply is provided by a full wave selenium metal rectifier W1 type Westinghouse EC1. The parallel heater chain is balanced to chassis by means of a pre-set potentiometer R28 across the heater winding of T2.

Replay

The replay head output voltage is switched by S1c (contacts 3 and 2) to the grid of V1A (ECC83) the other side of the head winding being returned to chassis via S1c (contacts 5 and 6). The amplified signal 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 negative feedback loop switched by S1a (contacts 2 and 3) from V2A anode to V1B cathode gives treble boost playback equalisation.

V2A output is fed direct to "radio" output socket via attenuator R17/R30 and S1b (contacts 11 and 12) and via C21/R29, which provides attenuation at low frequency, to tone control R20. From the tone control the signal is switched by S1a (contacts 5 and 6) to the grid of V2B via grid stopper R24. V2B operates as the audio output stage, with the erase head short circuited by S1b (contacts 14 and 15). The secondary of T1 is connected in the return circuit of the cathode of V2B to provide negative feedback. An internal loudspeaker muting switch S2 is fitted. In the replay condition HT supply to V3 (EM84) the record level indicator is disconnected.

Record

V1A grid is switched to microphone and radio inputs, and to

the pick-up input via an attenuator R6, by S1c (contacts 1 and 2). Switch contacts are incorporated in the microphone socket 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. V1B and V2A, the next two stages, have a frequency selective negative feedback loop switched between them by S1a (contacts 1 and 2) from anode of V2A to cathode of V1B to provide treble boost recording equalisation.

V2A output is fed to the record/playback head via a bias frequency filter R16/C7, a DC blocking capacitor C24 and series resistor R18, to provide constant current drive. The record/replay head winding is returned to chassis through S1c (contacts 4 and 5). Part of the signal developed at V2A anode is rectified by W2, and fed to the grid of V3 the record level indicator. HT to this valve is supplied through S1a (contacts 7 and 8). The values of C17 and R31 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".

S1a (contacts 4 and 5) connects V2B grid to the oscillator inductance L1 through C14 which provides self bias in conjunction with R21 and R23.

The oscillator is tuned to approximately 54 Kc/s by L1/C13 and the output is fed to the erase head via C23 and to the recording head through C10. The value of C10 has been chosen so that optimum recording bias is maintained.

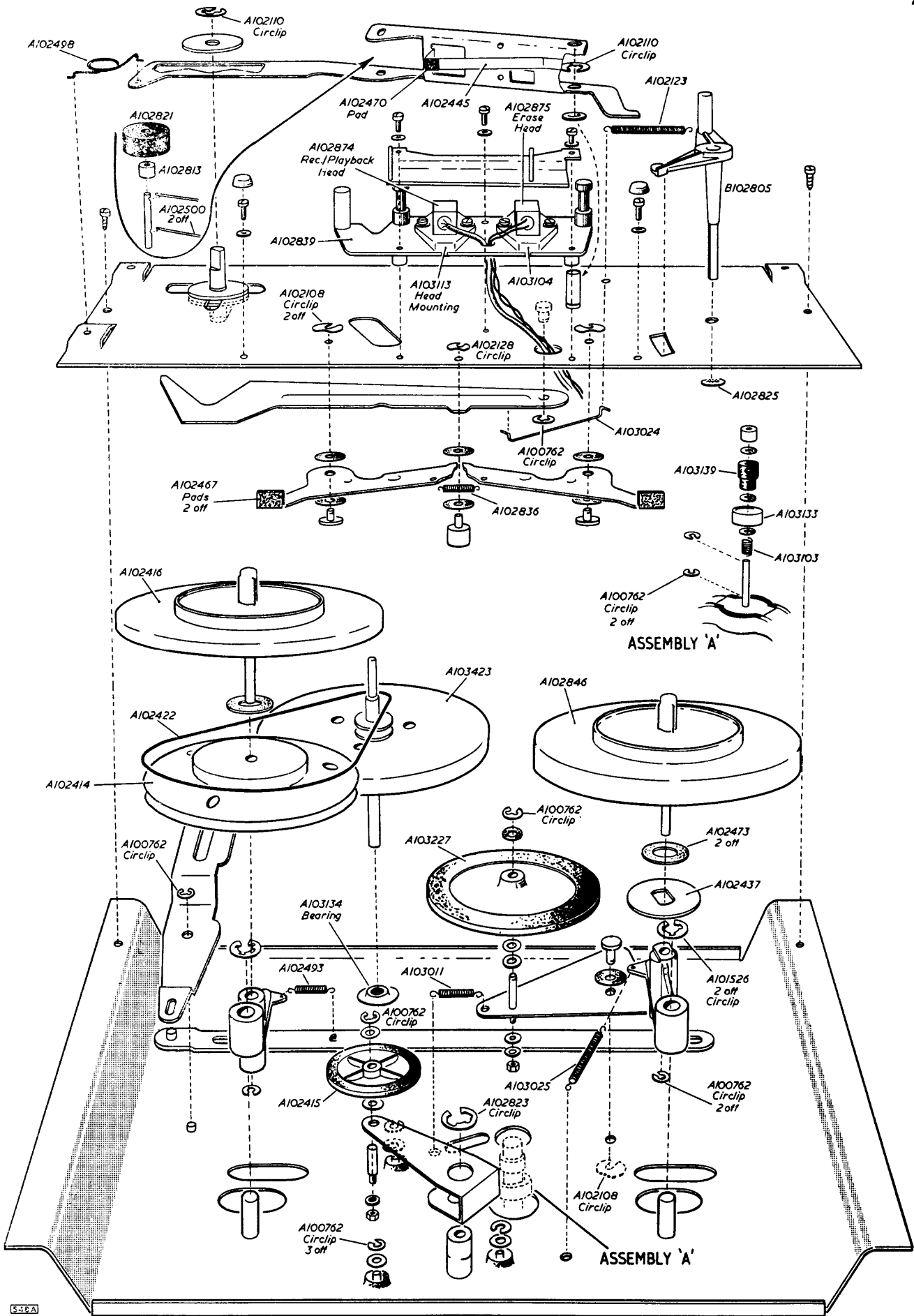


Fig. 4. Exploded view of tape deck. Should any components become worn or broken, replacements can be obtained from BSR Service. It should however, be noted that the deck illustrated is fitted to the Mark II. The Mark I capstan is driven by belt from the motor pulley and following Part Nos. should be quoted instead of those in the diagram.
 Motor pulley A102847 Belt A102441 Capstan Assembly A102411

RESISTORS

All $\frac{1}{4}$ Watt carbon 20% tolerance unless otherwise stated

Ref.	Value	Rating	Function and Part No.
R 1	10M Ω		V1A grid leak
R 2	220K Ω	5% HS	V1A anode load, 224GCO2
R 3	22K Ω		Radio input and part pick-up attenuator
R 4	2.2K Ω		V1A cathode bias
R 5	1M Ω	Log. Pot.	Volume/Record level control, 13144
R 6	1M Ω		Part pick-up input attenuator
R 7	220K Ω		V1B anode load
R 8	2.2K Ω	10%	V1B cathode bias/NFB injection
R 9	330 Ω *		Part record/play treble boost
R10	100K Ω	10%	} Part record treble boost
R11	100K Ω	10%	
R12	22K Ω		
R13	2.2M Ω		
R14	1.8K Ω		V2A grid leak
R15	100K Ω		V2A cathode bias
R16	10K Ω	10%	V2A anode load
R17	220K Ω		Part bias filter
R18	91K Ω	5%	Part "radio" output attenuator
R19	100K Ω		Record head signal feed, 913GCO2
R20	1M Ω	Lin. Pot.	W2 stand off
R21	680K Ω		Tone control 13145
R22	4.7K Ω		V2B oscillator grid leak
R23	1.8K Ω	10% $\frac{1}{2}$ W	} HT smoothing
R24	10K Ω		
R25	390 Ω	10% $\frac{1}{2}$ W	V2B grid stopper
R26	470 Ω	10% 1W	V2B cathode bias
R27	680K Ω	10%	HT smoothing
R28	200 Ω	Pre-set	V3 anode load
R29	220K Ω		Heater balance (humdinger), 13007/4
R30	22K Ω		Part low frequency attenuator
R31	10M Ω		Part "radio" output attenuator
R32	220K Ω	10%	V3 grid leak and W2 load
R33†	2.2M Ω		Replay NFB (bass boost)
			V2B grid return

* On some recorders this will be 270 Ω

† Mark II only

MISCELLANEOUS

Ref.	Description	Part No.
S1a-b	} Record/Play switch wafer	} 16592/1
S1c		
S2	Internal/external loudspeaker switch	18294
S3-4	Mains On/Off switch	13145
LS	8 inches x 3 inches elliptical, 3 Ω speech coil	16015/5
W1	HT rectifier	17599
W2	Record level rectifier	18296

CAPACITORS

All 350 Volts 20% tolerance unless otherwise stated

Ref.	Value	Rating	Function and Part No.
C 1	.002 μ F	400V	V1B grid coupling
C 2	200 μ F	Elec. 6V	V1A cathode bypass
C 3	.01 μ F	400V	V2A grid coupling
C 4	.02 μ F		Part record/play treble boost
C 5	300pF	10% 150V	Part record/play treble boost
C 6	50 μ F	Elec. 12V	V2A cathode bypass 13210
C 7	500pF		Part bias filter
C 8	220pF		Part tone control
C 9	1000pF	10%	Replay NFB (bass boost)
C10	47pF	10%	Record bias feed
C11	32 μ F	Elec. 275V	} HT smoothing 13236/10
C12	32 μ F	Elec. 275V	
C13	1500pF	2%	Oscillator tuning
C14	500pF		Oscillator grid coupling
C15	3000pF		Oscillator anode coupling
C16	50 μ F	Elec. 300V AC 25V	V2B cathode bypass 13228/4X
C17	.02 μ F	150V	Level indicator time constant
C18	32 μ F	Elec. 300V	HT smoothing
C19	32 μ F	Elec. 300V	HT reservoir
C20	0.1 μ F	250V	V2A anode DC blocking
C21	.01 μ F	400V	Part low frequency attenuator
C22	33pF		Input decoupling
C23	0.5 μ F	150V	High pass filter
C24	.04 μ F	150V	DC blocking

INDUCTOR AND TRANSFORMERS

Ref.	Description	Part No.
L1	Bias oscillator coil	18295
T1	Audio output transformer	18313
T2	Mains transformer	18312

SPARE PARTS LIST

Description	Part No.	
	MK I	MK II
Baffle	18299	*
Cabinet	17737	17743
Connecting lead	18290	18290/1
Control knobs :		
Volume control	} 25157/2	} 25157/2
Tone control		
Clip for above	45931	45931
Record/Play	} A102456†	} A102456†
Mechanism control		
Clip for above	A102635†	A102635†
Cover (moulded)	18297**	18397
Fillister head fixing screw for above	SB4F04/N	SB4F04/N
Handle	18317	*
Head cover	18370	18370
Mains lead	18286	18286
Microphone	18287	18287/1
Tape deck	16148	16148/1

*Supplied complete with cabinet

†Obtainable from BSR service

**Latest type will be supplied with six mounting holes

FERGUSON RADIO CORPORATION LTD

GREAT CAMBRIDGE ROAD, ENFIELD, MIDDLESEX

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GLASGOW : 160/162 BATTLEFIELD ROAD, S.2. Telephone : Langside 9251/2/3/4